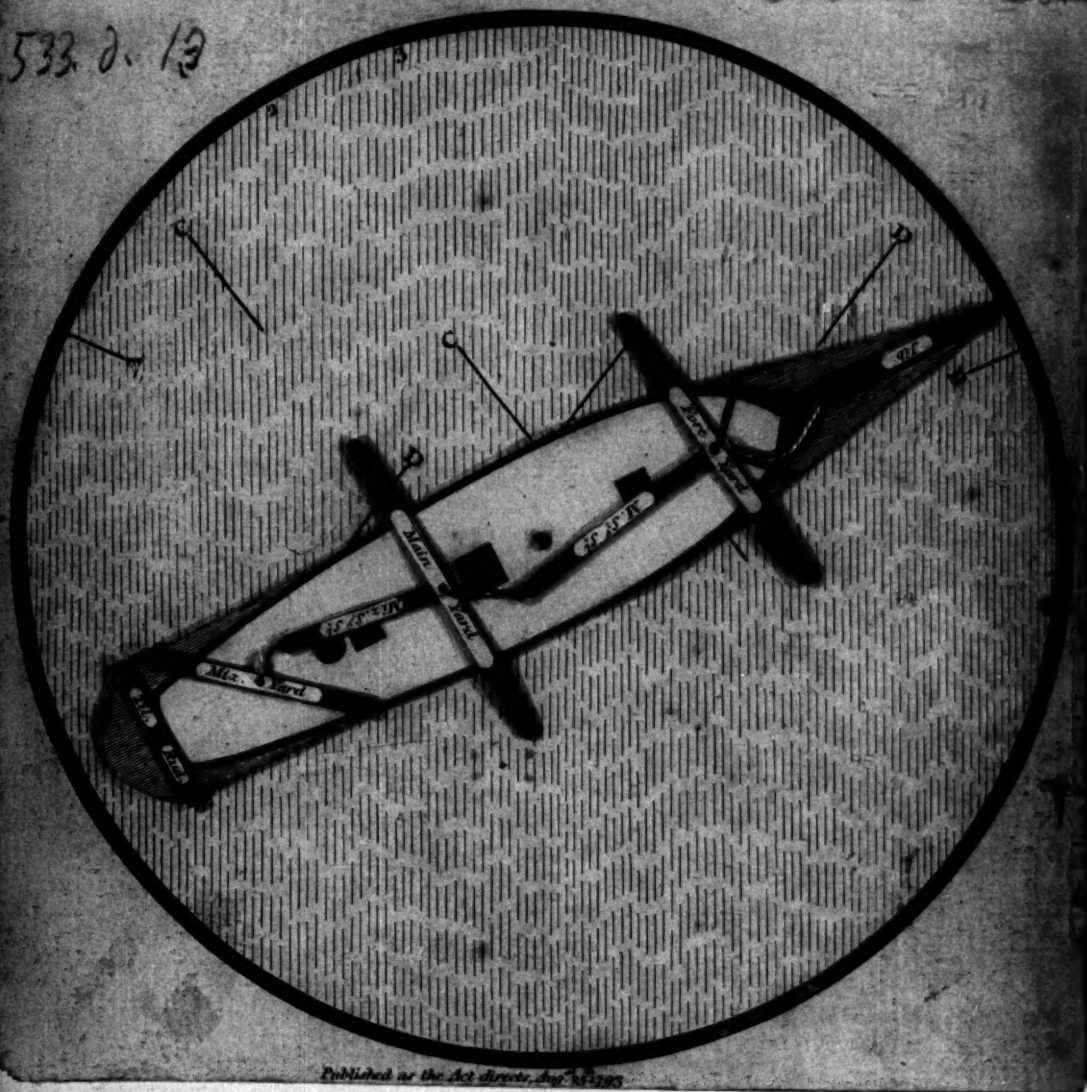


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TREATISE

ON THE

THEORY AND PRACTICE

OF

SEAMANSHIP:

Containing general Rules for manœuvring Vessels, with a *moveable Figure of a Ship*, so planned that the Sails, Rudder, and Hull may be made to perform the Manœuvres according to the Rule laid down. To the above is added a Miscellaneous Chapter on the various Contrivances against Accidents, and a Copper Plate of the Diagrams and Figures explained in the Work; the whole forming a useful Compendium to the *Officer*, to Instruct him when *Young*, and to Remind him when *Old*.

BY

AN OFFICER.

IN THE SERVICE OF THE INDIA COMPANY.

LONDON:

Printed for G. G. and J. ROBINSON, Paternoster Row; and
GILBERT, WRIGHT, and HOOKE, N^o 148, Leadenhall Street.

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[Price FIVE SHILLINGS Bound.]

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THEORY AND PRACTICE

SEATTLE



to furnish him with a year, and to remind him when his work, the whole forming a useful Compendium to the Officer, Copper Plate of the Diagrams and Figures explained in the Chapter on the various Contingences against Accidents, and the Rule laid down. To the above is added a Miscellaneous Hull may be made to perform the Manœuvres according to the Figure of a Ship, and the Sails, Rudder, and Containing general Rules for manœuvring the Vessels, with a variety of other particulars.

AN OFFICER

IN THE SERVICE OF THE INDIA COMPANY.

L O N D O N

Printed for D. G. and J. Robinson, Paternoster Row; and
Gillman, Wright, and Moore, 11, St. Andrew's Street.

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Liberty

For an explanation of the terms used in this work, and in defence of the orthography, the reader is referred to the

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will be found, most probably, as elegant

AT the request of several friends, the author of the following pages has been induced to commit them to the Press. They contain practical rules for manœuvring vessels, more properly termed *seamanship*; and may serve as a remembrancer of facts, to be adverted to in the immediate time of need. With them is combined the *theory* of practice, the ideas of which have been chiefly gained from the profundity of Euler, and the simplicity of Franklin.

When the prices of most books on *Seamanship* are considered, it is hoped that this little treatise will be thought reasonable, especially since the Figure at the beginning of the work is a matter of some nicety.

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For

As

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TREATISE
ON THE
THEORY AND PRACTICE
OF
SEAMANSHIP.

CHAP. I.
*Respecting the Properties of Vessels, and the
Action of Fluids.*

Upon the Floating of a Vessel.

FOR a vessel to float, she must displace a bulk of water equal to her weight; from whence it follows, that as much water as would fill the cavity the ship has made, would be the exact weight of the vessel and her contents. For, imagine a vessel floating in water perfectly tranquil to be suddenly lifted out, the tranquillity will be immediately disturbed, and the water will rush from the surrounding parts to restore the equilibrium, which will not be perfect till the cavity is filled up. Now, if it is considered that an equilibrium can only be brought about by an equal momentum, it is clear, that the water which

B

now

now fills up the cavity exerts as much force on its surrounding water, as the ship in the former case; therefore their weights must be precisely alike.

Upon the Centre of Gravity.

The centre of gravity of a body is that point by which it may be suspended, and the parts remain in perfect equilibrium.

Upon the Centre of Cavity.

By the centre of cavity is meant the centre of gravity of the hollow the vessel makes in the water, which is also the centre of the force that the water exerts to support the vessel.

Upon the Centre of Motion.

Respecting the place of the centre of motion, authors have differed. To me it appears to be at the centre of the round of the vessel's bottom; and, if the bottom is perfectly circular, that it will not change its situation, though the centre of gravity of the vessel should variously alter. Let us farther consider this point: suppose a hollow cylinder, the half of which in some measure approaches the shape of a vessel, to be loaded at one part of its interior surface till it will swim in water the depth of its centre parallel to its length; then let it be rolled to
and

and fro, and its centre will be found to have the least motion. Now, let the same load be moved higher up towards the centre of the cylinder, the surface of the water will still cut the centre of the cylinder, as the load has not been lessened; and if it be rolled, the centre will yet be found to have the least motion.

Again: let the load be reduced, so that the centre of the cylinder may float above the water; roll it, and it will be seen that the least motion is yet in the centre of the cylinder, for the centre cannot be brought nearer to the surface of the water; and in every possible case, be the load light or heavy, and the centre of gravity variously altered, still the centre of motion will ever be at the centre of the cylinder; from which it may be concluded, that the centre of any similar body as a vessel, will also be the centre of motion. Having established the three foregoing points, we shall proceed to explain the reason of the stability of vessels.

Upon the Stability of Vessels.

The stability of a vessel depends upon the momentum of her centre of gravity, which must be placed below the centre of motion; and the greater the momentum, the greater will be her stability.

The momentum may be increased by two means. First, by augmenting the weight so that the centre

of gravity may preserve the same distance from the centre of motion; or, by placing the same weight lower in the vessel, that the centre of gravity may be removed farther distant from the centre of motion. Thus the stability, or momentum of a vessel's centre of gravity, may be gained, by deducting the weight of the vessel above the centre of motion from the weight below, and multiplying the remainder by the distance of the centre of gravity from the centre of motion. To make this more clear, let us consider it by the assistance of a figure.

Let the half circle ABD, fig. 1, represent the transverse section of a vessel's bottom; HO the surface of the water; M the centre of motion; C the centre of cavity; G the centre of gravity; and the line GM the vertical axis of the vessel, which may be turned round the point M, as a fulcrum supported by the centre of cavity. By thus simply considering the vessel as a lever in the direction of her vertical axis playing round her centre of motion, it is plain, that if the centre of gravity was placed above the point M, the vessel would upset; therefore, that the ship may have stability the centre of gravity must be below this point: and it may be observed, that the farther G is removed from M, the greater must be its momentum, as the gravity then acts with a greater length of lever; or, if the weight at G be augmented, it will likewise increase the momentum; therefore the
momentum

momentum of G may be expressed by multiplying the balance of weight beneath the centre of motion by the distance GM .

REMARKS.

The centre of cavity and motion will ever be in a line perpendicular to the horizon, but the centre of gravity may be either on one side or the other of this line. When the ship is at rest, the centre of gravity will be in this line; but if the ship is in motion it will be diverted from it. Thus the points M and C , fig. 1, will always be perpendicular to HO , but the point G , by the vessel's rolling, may be on either side; for instance, at g . While G is perpendicularly beneath the centre of motion, its action can only tend to preserve the vessel in her erect position; but if it is removed to either side, as to g , its action is to return the vessel to her erect position; and this action increases as the distance Gg , which is the sine of the angle of roll gMG , the distance MG being considered as the radius. Thus, to gain the momentum of gravity with any roll as gMG , let the balance of weight beneath the centre of motion be multiplied by the sine of the angle of roll Gg .

Upon the Difference of Stability between the Length and Breadth of a Vessel.

Let us now examine why there is so great a difference of stability between the length and breadth of a vessel. A vessel easily inclines round her longitudinal axis, but is with much difficulty inclined round her transverse axis. For this purpose let HO, fig. 2, represent the surface of the water; HGO the curve of a vessel's longitudinal section, of which E is the centre; and let the smaller circle represent the curve of her transverse section, of which B is the centre; and G the centre of gravity of the vessel. Now, if the vessel be given a motion round her longitudinal axis, B is the centre of motion or top of the fulcrum which she turns upon, and her stability in this respect is as the distance from B to G; but if she be given a motion round her transverse axis, E will be the centre of motion, and her stability in this respect as the distance EG, which is much greater than BC.

At present we have only examined the stability of vessels upon a supposition that their bottoms are circular; we shall now shew, that, by increasing their breadth, the stability may be greatly augmented.

Let us suppose that the transverse section, fig. 1, be allowed more beam, and increased by the dotted lines.

lines. Now, when this vessel is rolled over, it is plain that the cavity will be augmented towards the side O, of course its centre must remove towards O, say to E; and if from E be erected a perpendicular to the horizon, it will cut the vertical axis at m, which will, in this case, be the centre of motion; and her stability will be increased as the distance from M to m. The same reasoning will tend to shew, that if the longitudinal section, fig. 2, was increased at the bow similar to the dotted curved line, a vessel's stability may be yet more augmented by her build, with respect to her length.

REMARKS.

When sailing in smooth water, the greater the stability the better; but if a vessel with a heavy cargo, stowed low in her bottom, be sent out into a rough, tempestuous sea, where every wave will throw her from her equilibrium, she will return with such violence as to endanger her masts; and should she be dismasted, her roll will then be with still greater force, possibly to the destruction of her hull. Was the cargo in this laboursome vessel to be removed higher up towards the centre of motion, so as to lessen her stability, she would be found considerably easier; her roll would be by such deliberate motions, as to lessen the danger to her masts and hull.

It is to be wished that some fixed rule could be established for giving the necessary stability to a

vessel. Probably it might be required, that after a ship has 30 degrees of roll, her stability should then be such as to resist the greatest force of the wind sideways upon her hull and rigging. Now, by knowing the length and diameter of the different ropes and masts, it will not be difficult to determine the surface they oppose to the wind, which, added to the side surface of the hull above water, or above the centre of motion, will give the whole surface opposed sideways to the wind: and if this whole surface in feet be multiplied by the greatest force of the wind, in the hardest gale upon a foot surface, we shall have the greatest force of the wind acting laterally upon the ship; which let be reduced as the square of radius is to the square of the sine of the angle of incidence, viz. 30 degrees, and there will remain the whole effort of the wind acting sideways upon the ship, when rolled over 30 degrees; the centre of which effort will be about two thirds from the top-mast-head to the centre of motion. Now, if the whole effort be multiplied by the distance of the centre of effort from the centre of motion, it will give the momentum of the wind upon the ship with a roll of 30 degrees; and for the vessel now to have a sufficient stability to prevent her from rolling over any more, the momentum of gravity beneath the centre of motion must be made equal to the momentum of the wind.

Upon

Upon the direct and oblique Impulses of Fluids.

In considering the impulses of fluids it must be remembered, that it is of no consequence whether the fluid strike the body or the body the fluid; that is, the impulsion against the bow of a ship at anchor in a tide of three knots, is the same as if the ship sailed three knots through the water.

THEOREM.

A Fluid strikes a Surface perpendicularly as the Square of its Velocity.

DEMONSTRATION.

A body in motion strikes another perpendicularly, which is at rest, with its momentum, that is, with a force equal to its mass multiplied by its velocity; and if the mass of the body be called one, it is easily conceived that a body will strike or impel another with a force that may be expressed by its velocity; but a body moving in a fluid will have to encounter more bodies as its velocity increases, for with six times the velocity it will encounter six times the number of bodies, or particles, and each particle will strike with six times the force; therefore the body in motion will be shocked by the fluid with an impetus of six times six, which is the square of the velocity.

For

For the sake of an example to elucidate this matter more clearly, suppose six shots to be placed in succession at a foot distant from each other, and that a body be forced against them with the velocity of one foot in six minutes, in six minutes, therefore, it can receive only the impulse of one shot; but if the body be given six times the velocity, in six minutes it will have received the impulse of all the shot, and each shot, by this increase of velocity, must strike with six times its original force; therefore the body will have received the same shock as it would receive by being struck with 36 shots, having a velocity of one foot in six minutes, which is the square of the velocity.

Though a fluid strikes a surface perpendicularly as the square of its velocity, yet, *if the surface be presented obliquely to the fluid, its force will be diminished as the square of the sine of incidence.*

- DEMONSTRATION.

If a body or particle as A, fig. 3, strikes a surface BD at B, with the direction and force AB, it will be deflected off in the direction BE, and impart to the surface a perpendicular force BC, which is equal to AD, the sine of the angle of incidence.

Again: should a surface be placed perpendicular to the motion of a fluid or number of particles, it will then be struck by as much as it can oppose;
but

but if the same surface be presented obliquely to the fluid, it will not oppose so much of it by the sine of the angle of incidence.

DEMONSTRATION.

Let DC, fig. 4, represent the direction of the fluid; AB the surface opposed to it perpendicularly, in which position it will obstruct all the fluid passing between the lines A and B; but if this surface be placed obliquely to the fluid, as AC, it will only obstruct the quantity between the lines AD, which are separated by the sine of the angle of incidence ACD; therefore the force of a fluid against an oblique surface diminishes from two causes; first, because the particles of the fluid, by striking the surface obliquely, do not exert upon it their whole force; and, secondly, because there are not so many particles striking: both of which diminutions follow the ratio of the sine of incidence, which together is the square of the sine of incidence.

Upon the Point Velique.

By the point velique is meant that point where a perpendicular from the centre of gravity of a vessel is met by a line in the mean direction of the effort of the water upon the bow. To explain this more clearly: let AB, fig. 5, represent the keel of a vessel; BC the curve of the bow; AD a perpendicular through

through the centre of gravity; CD the mean effort of the water upon the bow; then the point D is the point velique: and let the force applied against D, in a direction to push the vessel onward, be ever so great, it can only tend to give her a direct motion, and raise her in the water parallel to herself; but should the force be applied above that point, the bow will be forced down into the water; if below, the bow will be lifted out of the water; in either case, altering the trim of the vessel. This point can only be exactly found when sailing before the wind; for by sailing obliquely to the wind CD will come from the lee-bow, and pass to windward of the perpendicular without cutting it: therefore in this case there will be no determination.

From what has been said of the point velique, it may be easily conceived, how necessary it is that all vessels should have their masts of such a height, that the centre of effort of the sails may meet, or be the same height with it, otherwise the forcing the vessel from her parallelism may greatly retard her sailing, and make her extremely laboursome, particularly in a high sea.

*Respecting the Action of the Wind upon a Sail, and its
Centre of Effort.*

The action of the wind upon a sail is perpendicular to its surface; and if the wind strikes it perpendicularly, the centre of effort will be the middle
of

of the sail; but, *if the wind strikes the sail obliquely, the centre of effort will be removed towards the weather-leech.*

DEMONSTRATION.

Let BD, fig. 6, represent the surface of a sail; AB, CD, the direction of the wind striking the sail. Now, if CD strike the sail near the weather-leech, as for instance, at D, it will be deflected in the direction DE, and impart a force to the sail in the direction DF; but if the lee-leech is struck by the wind AB at B, it will be deflected off towards E, and will not impart the same force, for AB must lose a great deal of its force by having to pass through all the deflected wind between D and B. The same reasoning may be applied to the wind's striking any intermediate part of the sail, and proves that the wind gradually loses its power as it strikes nearer the lee-leech; which must cause the centre of effort to approach the weather-leech with an oblique wind. This is practically seen by the strain always resting upon the weather-brace.

Respecting the Action of a Sail upon a Vessel.

The action of a sail upon a vessel, if the yard be square, will be to force her in the direction of her keel, either ahead or astern; but if the yard be braced up obliquely to the keel either way, the sail will act two ways, one in the direction of the keel,
the

the other in the direction of the beam; yet though the yard should be so braced, as to cause the action in the direction of the keel and beam to be alike, still the head-way or stern-way will considerably exceed the lee-way, because the head or stern of a vessel meets less resistance from the water than either side.

Upon the best Angle to brace a Yard up to for its Sail to be of most Service.

The angle being given between the wind and the keel, it is required to know how this angle should be divided by the yards, that the sails may be of most service.

For this purpose, let KK, fig. 7, represent the direction of a vessel's keel; C6 her beam; AB any of the square sail yards, as the main-yard; 22 the yard braced up 10 degrees more; 33 braced in 10 degrees less; WC the direction of the wind. Now, of the angles WC₃, WCA, WC₂, one must be more advantageous than the others for increasing the velocity in the direction of the keel.

The action of the wind upon a sail, it should be remembered, is perpendicular to its surface, and the force with which it acts is as the square of the sine of incidence; therefore draw perpendicular to the yard, in the three different positions, the forces CD, CE, CF, proportioned to the squares of the sines

sines of the different angles of incidence WC_3 , WCA , WC_2 , and they will represent the power of the sail upon the vessel in the three different positions of the yard. Now draw the parallelogram CD , CE , CF , having two sides parallel to the keel, and two to the beam, then these sides will represent the lateral and direct forces arising from the three total forces CD , CE , CF . The direct forces are those only which we need consider. The position of the yard AB gives a direct force of C_5 ; the position 33, where the yard is braced in 10 degrees, gives C_4 ; and the position 22, where the yard is braced up 10 degrees, gives the same, which is less than C_5 . Now, as either bracing in or bracing up, from the position of the yard AB , gives less, it is evident that the position AB is the best that the yard can make with the keel for increasing the head-way; and this position will never be attained but when the tangent of the angle of incidence WCA is double the tangent of ACK , the acute angle that the yard makes with the keel.

Upon the Effect of the Rudder.

The effect of the helm is produced by the water passing the vessel and acting upon one side of the rudder; consequently the ship's stern must be forced to the contrary side.

Thus: suppose the helm was put astarboard, in the position BC , fig. 8, and that the vessel should be
given

given head-way; now, by the water's passing from A towards B, it must necessarily strike against the larboard side of the rudder, and force her stern towards D, her head taking the opposite direction towards F, the vessel turning about some point (E) before the centre of gravity. On the contrary, let stern-way be given to the vessel; then, by the water's passing from B towards A it must act against the starboard side of the rudder, and force her stern towards H, at the same time that her head moves towards I; but, when the helm is in the direction of the keel, the water can act no more on one side of the rudder than the other, therefore no rotation of the vessel will follow.

From the foregoing reasoning the following rule is deduced, which should be well remembered.

If the vessel has head-way, the helm being put astarboard turns her head to port; if put to port, it turns her head to starboard: and if the vessel has stern-way, the helm astarboard turns her head to starboard, the helm aport turns her head to port.

Upon the most advantageous Angle for the Rudder to make with the Keel.

There certainly must be one angle more advantageous than the rest for the rudder to make with the keel to gain the greatest power. If a figure be drawn representing a fluid striking a surface as a rudder, at different degrees of incidence, with forces

as the squares of the sines of the angles of incidence; upon examining this figure it will appear that the greatest lateral impulse, or that which is in the direction of the beam, will be, when the fluid strikes the surface, at about 35 degrees; but then the impulse in the direction of the keel being much greater than the lateral, is consequently destructive of a considerable quantity of the vessel's head-way. Let the incidence of 45 degrees be examined, and it will be found that the lateral and stern impulses are alike, and that the lateral impulse is very little less than that at 35, while the stern impulse has considerably decreased; therefore, it may be concluded that an angle of 45 degrees is the most advantageous for the water to strike upon the rudder. To the bottom of the rudder the water certainly comes in the direction of the keel; but above that point, up to the water mark, it must come to the rudder in the different directions of the vessel's run. The mean spread of the run let us suppose to be 20 degrees, the half (10) will then be the angle which the water makes with the keel when thrown out of its direction towards the bow; therefore, for the rudder to be struck at a mean by the water with an angle of 45 degrees, the tiller must move over 35 degrees. This is about the greatest angle that is in general practice, few large vessels having their tillers to go over more; many indeed go over less, not even exceeding 20 degrees.

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REMARKS.

REMARKS.

The vessel whose rudder answers every purpose, and goes over only to a small angle, has certainly the advantage of a vessel whose rudder answers well, but goes over more; for the first has enough of lateral force without much stern force; while the other, to gain a sufficient quantity of lateral force, augments her stern force to a considerable degree.

If rudders which now go over to 35 or 40 degrees, and which answer their intention perfectly well, were to have their side surfaces increased to nearly double, and be suffered to move over only 20 degrees, then the lateral force would be increased, and the stern force considerably diminished. I am aware that the increasing of rudders, according to the present mode of shaping them, will be objected to; but if they were to be allowed greater breadth at their heels, and to be tapered away gradually upward so as to have a triangular form, they would have more side surface at the part where the fluid comes with the greatest force, and less useless wood above water for the sea to strike against.

Respecting the Action of Sails upon a Ship before and abaft the Centre of Gravity.

Let AE, fig. 9, represent the longitudinal axis of a ship; C the centre of gravity, or point round which the ship would turn; A the centre of action

of

of the sails upon the bowsprit; B the foremast; D the mainmast; E the mizenmast. Now, should the momentum at D and E act on the same side, and be equal to the momentum at A and B, no rotation of the ship would follow; but should this momentum be lessened, or taken off, either before or abaft the centre of gravity, the ship will immediately revolve with a less or greater motion. From which reasoning it follows, that with the head sails full, and the after sails shaking, the ship will veer; but with the after sails full, and the head sails shaking, the ship will come to. Likewise, if the sails before and abaft the centre of gravity be equally trimmed, the ship will neither fall off nor come to.

Having treated of the necessary theory in the preceding pages, we shall in the next chapter enter upon the practical part of seamanship, which every officer ambitious to be alert at his duty should make himself perfectly acquainted with; that his mind may be as quick to conceive what ought to be done as a ship is rapid in her evolutions. Was the young mariner, at his leisure hours, to employ his mind in reflecting on the various circumstances to which a ship is liable, and apply his theoretical knowledge to the more immediate event in point, his mind would be stored with many excellent rules which would readily occur to him at the moment of need.

CHAP. II.

*Upon manœuvring a Ship under Sail.**To tack a Ship.*

To tack a ship, let the sails be trimmed sharp, and every man be sent to his station; hands in the tops to bear the back stays abaft and abreast, to shift over the stay-sail-tacks, &c. and let all the ropes be clear and stretched along upon deck; then put the helm down, and call out, *helm's alee, fore sheet, fore-top-bowline, jib and stay-sail sheets let go!* The wind out of the main-sail, *raise tacks and sheets!* and haul well taught the weather after-braces for a good haul. The wind about a point, or two points upon the bow, so as to back the weather-leech of the main-top-sail, *main-sail haul!* sharp round with the after-yards, and watch her way; if she has no way, right the helm; if stern-way, shift it. The after sails full, *let go and haul!* round briskly with the head-yards, and trim all sharp.

REMARKS.

Should it blow fresh, be careful to set the back-stays up when in stays.

The practice of bracing to the head yards is disapproved of, as tending to destroy the headway, thus
losing

losing the effect of the rudder, which is of more consequence: and the reason for hauling the main-sail with the wind upon the bow is, that the wind then taking aback the weather-leech of the main-sail and main-top-sail, causes the after-yards to fly round of themselves, bringing the clew of the main-sail flat aft to its proper place, that the people have only to run in briskly with the slack of the sheets and braces.

If the water be tolerably smooth, and the whole evolution be performed with spirit, the ship will seldom get stern-way, and will therefore require only the righting of the helm.

Should the ship after coming about fall off considerably, let fly the jib and fore-stay-sail sheets, and keep in the head-yard till she comes to; then brace up, and trim sharp.

If it be expected, from there being much sea upon the weather bow, that the ship will not come about, it will be proper to haul down the jib and fore-stay-sail before the helm is put alee; and at all times when these sails are set, the officer forward should be particularly careful that the fore-castle-men do not haul over their sheets too early, which they frequently are guilty of from an over-anxiousness to be forward with their duty, and thus often prevent the ship from staying. While the helm is putting alee, let it be done gradually, and if the ship has

quick headway she will seldom require the helm to be put hard over to bring her about.

It sometimes happens that a ship will refuse staying even after the main-sail is hauled, and from that time fall off. In this case, haul up the main-sail, mizen, and mizen-stay-sail; square the after yards, and keep the helm as it was, for she will have stern way. This position of the sails and helm will cause her to fall off briskly upon her heel. As the after sails fill and she gathers headway, shift the helm, and proceed as if veering.

Having mentioned the manner of tacking a ship, we may now proceed to explain the *large figure* at the beginning of this work, which is intended to assist the reader with a clear idea of the nature of the various evolutions of a ship.

Explanation of the large Figure at the Front of the Book.

The circle is meant to represent the horizon; the dashed lines across the circle represent the wind, blowing from the upper part of it. The figure made to turn in the centre of the circle, is a representation of a ship moving round her centre of gravity before the main-mast, with her sails and rudder having their names written upon them. The shade at the head and stern is intended to represent the water passing either aft or forward, as the imagination may conceive the ship to have either head or stern-way. The yards inscribed *fore-yard, main-yard, and mizen-yard,*

yard, may be imagined to represent the whole of the square sails upon each mast, for all the sails upon each mast are but one great sail, having the same action, being divided into smaller for the convenience of being more easily managed. The same may be said of the stay-sails: therefore, let these likewise represent the smaller stay-sails above them. There are no braces placed to the yards, because it was wished to keep the figure as simple as possible: it was found necessary, however, to give sheets to the stay-sails to keep them in their proper position; therefore, whenever it is necessary to let go any particular stay-sail sheet, it must only be imagined to be done. After this explanation, we shall go through an evolution by the figure, which it is to be hoped will make it so clearly understood, that any other evolution may be attempted without explanation.

To tack a Ship by the Figure.

To tack the figure, trim it sharp to the wind by placing its head in the direction of the line A; then brace the yard up in the directions of the lines CCC, and bear the jib and stay-sails over to leeward. The figure or ship is then trimmed sharp, six points from the wind upon the starboard tack. Now put the helm alee, and imagine the fore-sheet and fore top-bowline to be let go, and move the figure gradually to the wind, as if it were done by the action of the rudder, till her head is in the direction of figure 2.

In this situation it is seen that the wind blows right along the yards, of course the wind is now out of the sails; therefore, *raise tacks and sheets!* or suppose it to be done. Then move her head further round to the direction of figure 3, about a point and a half from the wind, and it is seen that the fore-sail is flat aback, which now contributes most to force round the ship's head, as her way through the water must be nearly at an end, and the wind catches aback the weather-leech of the main-sail; therefore, *main-sail haul!* and brace round sharp the after-yards. The sails being now all aback, and the figure moved round about head to wind, it may be supposed that the headway has ceased, and sternway commenced; therefore shift the helm. The figure being moved to bring the wind on the other side, bear the stay-sails over to leeward, and keep moving round the figure till its head is in the direction of the line B, when it will be seen that the after-sails are full; therefore *let go and haul!* brace round the head-yards, right the helm, and trim all the yards sharp in the direction DDD, and the figure is now six points from the wind upon the larboard tack.

To veer a Ship.

To veer a ship, send the people to their stations; then haul up the main-sail, mizen, and mizen-stay-sail; put the helm aweather; let go the after bow-lines, and square away the after-yards. As she falls
off,

off, keep squaring the after-yards, just suffering the after-fails to be barely full. When the wind is nearly aft, raise the fore-tack and sheet; let go the head bow-lines, and square away the head-yards. The wind upon the other quarter, haul aft the mizen, and mizen-stay-fail sheets; brace up the after-yards; get on board the main-tack, and haul aft the main-sheet. As she comes to, brace up the head-yards, and get on board the fore-tack; and when she is to the wind, right the helm, haul flat aft the fore-sheet, —trim sharp,—and haul up the bow-lines.

REMARKS.

The method of shivering the after-fails is thought improper, as by tending to diminish the head-way much of the effect of the rudder is lost.

To Box-haul a Ship.

To box-haul a ship, haul up the main-fail, mizen, and mizen-stay-fail: raise the fore-tack and sheet; man well the weather head-braces and lee bow-lines; put the helm aweather; brace sharp aback the head-yards, and haul up the lee bow-lines; then shiver the after-fails, and keep them shaking as she falls off. Now watch her head-way, and when it is done, right the helm; and when she has sternway, shift it. As she falls round off from
the

the wind, she will quickly gather head-way again, when shift the helm a second time. The wind aft and round upon the other quarter, brace up the after-yards; haul aft the mizen, and mizen-stay-sail sheets; get on board the main-tack, and trim sharp the after-yards. As she comes to, trim sharp the head-yards, haul up the bow-lines, and right the helm.

To Club-haul a Ship.

Club-hauling is practised when it is expected that a ship will refuse stays upon a lee-shore. To execute it, place the hands to their stations for putting the ship about, and let two hands stand by the lee-anchor; then put the helm down; and should the ship make a stand before she brings the wind ahead, let go the anchor and haul the main-sail. When the wind is ahead, cut the cable, and the ship will cast the way required. The after-sails full, let go and haul.

The Manner of acting in a Squall.

The manner of acting in a squall depends so much on the moment, and on the judgment of the commanding officer, that it is difficult to prefix any precise rules. Every officer should remember, that all accidents which happen through his persisting to carry sail in a squall entirely appertain to himself.

The

The vigilant seaman should ever be attentive to the weather, and if he sees any clouds arise which he has reason to suspect carry wind with them, let him make the ship snug, by taking in all the smaller sails, studding-sails and driver. Should the weather still continue to gather, and a hard squall is expected, let the top-gallant-sails be furled; the jib be hauled down, and stowed; the mizen-top-sail lowered down, and the lee-clew-garnet of the main-sail hauled up: then place hands by the top-sail-haliards, and wait the expected wind. Should it come on to blow very strong, keep the ship off from the wind, and lower away the top-sails; and when the strength of the wind is over, either make sail, or reef, or hand, as is thought necessary.

The Manner of Acting when a Ship is brought by the Lee.

When a ship is brought by the lee, it is generally occasioned by neglect of the helmsman when there is a high sea and a quartering wind. Thus the careless helmsman by yawing of the ship to leeward of her course brings the sea upon the other quarter, which by striking the ship with violence, forces her stern round, and causes the wind to come broad on the opposite beam, throwing all the sails flat to the mast. Should the ship continue her way, she will, in all probability, recover her situation by the assist-

ance

ance of the helm, and brailing up the mizen and mizen-stay-sail; but should she lose her way, it will be necessary to brace about the after-yards, and even sometimes the head-yards, to give her fresh way through the water, when she will veer; then trim as before.

To Box a Ship off, and the Method of acting when taken aback.

If a ship is in the wind, through neglect of the helmsman, or through the wind coming suddenly more ahead, by putting the helm aweather, and brailing up the mizen and mizen-stay-sail, if she has head-way remaining, she will fall off; but should the head-way be at an end she must be boxed off; to do which, put the helm alee, raise the fore-tack and sheet,—brace sharp round the head-yards,—and haul up the lee bow-lines: in this position of the sails and helm, she must inevitably fall round off upon her heel. The after-sails being full again, brace about the head-yards, and trim sharp as before: but, should a ship be taken flat aback, or through neglect in not timely boxing her off, it should cause the wind to be broad upon the other bow, and it should be the wish of the officer to have her upon the same tack as before, then put the helm over to that side which just before was the weather: brail up the mizen, and
mizen-

mizen-stay-fail; raise the main-tack, and sheet; and square the after-yards. In this situation of the helm and fails, she will pay round off upon her heel; and when she has brought the wind aft, and gathered head-way, shift the helm. The wind round upon the other quarter, haul aft the mizen, and mizen-stay-fail sheets; brace up the after-yards; get on board the main-tack, and haul aft the sheet. As she comes to, right the helm, and trim sharp as before.

Upon Lying-to.

Lying-to may be effected several ways. The art is to produce a balance between the head and after-fails, so that their effects shall counteract each other. When lying-to is intended, the courses are generally hauled up, as being incommodious.

To Heave-to under the Top-Sails.

A ship being close under the top-sails, mizen, mizen-stay-fail and jib, it is required to heave her to. Thus situated, it is only throwing the main-top-fail to the mast, and putting the helm a little alee; but should the officer wish to prevent her from fore-reaching, let the mizen-top-fail be thrown sharp aback to the mast, and the helm be righted.

Another method is to throw the fore-top-fail square to the mast and to put the helm a little alee;
and

and should the fore-reach too much, let the mizen-top-sail be braced sharp aback, and the helm be righted.

REMARKS.

As a ship will fore-reach while she is lying-to with only one top-sail aback, she may be kept to the wind by the power of the helm; but with two top-sails aback, she will sometimes go ahead and sometimes astern, therefore it will be improper to keep the helm either way. For this reason she must be kept to the wind by the assistance of the sails; and as the action of a sail is perpendicular to its surface, the main and mizen-top-sail being braced sharp aback must contribute a very great lateral force upon the ship's stern to keep her to the wind. Again, when the fore-top-sail is braced aback only square, it acts with no lateral power to pay off the ship's head, while the mizen-top-sail by being sharp aback keeps her to the wind. If the ship lies well to the wind, the jib had better be kept up in readiness to veer her.

In different situations, both the foregoing methods of lying-to have their particular advantages. If a ship is to be brought to, to windward of another, the first method should be practised, as then she will be in readiness to fill and shoot clear of the vessel to leeward, should she drift too near her; but

but if the ship is to be brought to, to leeward of another, let the second method be practised, for should the windward vessel drift too near, by bracing sharp aback the head-yards and shivering the mizen-top-sail the ship will fall round upon her heel.

Of Sounding with the Deep-Sea-Lead, and the Manner of Heaving-to, to find Bottom at great Depths.

The art of sounding is the disposing of the sails in such a manner, as to suffer the ship to be perpendicular over the lead, at the time it reaches the bottom; the soundings thus had will be the true depth of the water.

In fine weather, while the ship's way does not exceed three or four knots, bottom may be gained from thirty to forty fathoms by heaving the lead from the sprit-sail-yard; but if the head-way increases, or the water grows deeper, the following method must be practised. The line being passed forward, and hands placed along to windward to attend it, the lead bent and all being clear, bring the ship to the wind, and brail up the mizen, and mizen-stay-sail; then put the helm alee, ease off the main-sheet, let go the main-top-bow-line, and brace the mizen-top-sail aback only square. Watch now the ceasing of her head-way, and heave the lead when it has sufficiently moderated. After bottom is

gained,

gained, let the line be hauled in as briskly as possible; then put the helm aweather, and trim as before.

Should the ship, by performing this evolution, prove likely to come about (which is scarcely possible if the helm be properly attended to), brace about the head-yards, and the helm being yet alee, by her stern-way she will soon pay off; then trim as before.

In hard blowing weather, at which time it would be dangerous risking the shaking of the sails, pass the line from the weather quarter round the bow to the lee fore-yard-arm, having a person with a small coil of line in his hand, well out upon the bow-sprit, to drop it clear of the forefoot; then haul the courses snug up, and bring the ship to the wind. When every thing is ready, brace aback the main-top-sail, put the helm alee, and heave the lead well out to leeward; thus the ship, by the time a large quantity of the line is out, will have drifted directly over the lead. Be careful to let the line be hauled in, before the main-top-sail is filled.

Of Lying-to in a Gale of Wind.

When a ship upon a wind is obliged to reduce almost the whole of her sails, through hard blowing weather, she is said to be lying-to, and the more her bow can be presented to the wind and sea the better,

as she will have less drift. The mode of effecting this, is as circumstances may require. If a ship is to be brought-to in a part where other vessels may be expected to be sailing in a contrary direction, the best sails to lie-to under are, a reefed fore-sail, mizen-stay-sail, and storm-mizen *, with the helm so much alee as is found best to answer the purpose. The reason for not putting the helm hard alee, which is the usual custom, is this, that when the helm is hard alee she will come up in the wind and shake the sails, causing her to get stern-way, and fall round off. On the contrary, were the helm never put so far over as to oblige the ship to come up in the wind, she would come-to and fall off much less: a ship thus brought-to will be in readiness for veering in case of necessity. Where there is good sea room, a reefed main-sail, storm-mizen and mizen-stay-sail are the superior sails to lie-to under, as a ship will keep to the wind under these sails without much of the lee-helm, and for that reason be very little subject to fall off or come-to in any considerable quantity.

If the sea be extremely high, and the ship very stiff and laboursome, she will lie-to better under a main-top-sail, which will prevent her rolling so rapidly by its lofty situation; and as this sail is much above the sea, it is not likely to be becalmed by

* A triangular sail to hoist upon a horse abaft the mizen-mast, having foot-rope enough to haul well aft to the taffarel.

the waves : it is extremely handy likewise to take in, should the wind increase to that violence as to make it necessary.

If a ship is to be brought-to in those latitudes where a sudden shift of wind is expected, the course stay-fails are the best fails to lie-to under, as then a vessel is in readiness for either tack, let the wind come as it may ; and should one of these stay-fails be blown away, it will very little effect the ship.

Upon a Floating Anchor to ride a Vessel in a Gale of Wind.

The fishermen in the North Sea, after they have driven from their anchors, make use of, what they term, a drogue-sail to ride their vessels by ; but this idea is much improved by Dr. Franklin, who has recommended a floating-anchor for that purpose, much in the shape of a kite, which is made to dive beneath the heave of the sea.

Such an anchor has long been wanting, and would be of material service to ships returning from India round the Cape of Good Hope, in which latitude it frequently happens that they are under the necessity of lying-to for several weeks together.

Construction of a Floating Anchor.

AB, CD, fig. 10, are two cross pieces of iron, in length about half the beam of the vessel the anchor

chor is intended for, and united by a bolt through their centres, that they may be swung together when the anchor is not wanted. At the end of the cross pieces are holes for the rope A D B C to pass through, which must be hove extremely taught. To this frame is fitted a strong double canvass cloth of the same shape, which is laced taught out to the rope. At the centre of the frame E is a crow-foot of four legs, coming from the cross pieces on each side of the centre, which meet in the loop above the centre towards B, so that when the crow-foot is pulled upon, the anchor may incline to the water and dive down, the same as a kite rises in the air. At A is a ring to which is bent the end of about 12 fathoms of rope, with a buoy at the other end, to prevent the anchor from diving lower than the length of the rope. When this anchor is to be used, let a hawser be bent to the crow-foot, and a small rope to the buoy; then put the anchor overboard, and veer away upon the rope and hawser to a sufficient quantity to ride the vessel, when it will have the appearance of fig. 11.

To get the anchor on board again, haul upon the small rope, which will cause it to come flat to the surface of the water, in which position it may be easily drawn to the vessel. It will be necessary to have the mizen-stay-sail in readiness to hoist, to keep the ship to the wind till the anchor is hauled on board and placed away.

Upon Scudding before the Wind in a hard Gale.

As the wind is perceived to increase, and a gale of wind is expected nearly in the direction of the course, from the appearance of the weather and the latitude of the ship, all expedition must be made to prepare the vessel for scudding before the wind and waves. Let the reefs be taken in, and the sails be furl'd in time. Let the top-gallant-yards and masts, mizen-top-sail-yard, mizen-yard and cross-jack-yard be got down upon deck, that the ship may be as snug as possible. Let preventer-braces be rove for the lower-yards, and let rolling tackles be hooked to all the yards, and bowsed well taught.

Should the sea run extremely high, there must be no dread of carrying sail, to give the ship as much head-way as possible, lest the sea should strike the ship with violence abaft. The best sails for scudding under are a reefed fore-sail, and double or close reefed main-top-sail; if these sails will stand the gale, there will be little danger of the masts.

As in scudding, the safety of the ship depends upon good steerage, great care must be taken to have excellent helmsmen, a compass by the tiller, and careful people to attend the relieving tackles, as either through want of experience in the helmsmen, or the breaking of a tiller-rope, the ship may be broached-to, and many ill consequences follow. The officer of the deck should be careful to have
the

the fore-sheets and preventer-braces clear, with hands to attend them, for should the helmsman broach-to the ship by bringing the wind so much on either side as to touch the sails, the head-yards must be immediately braced up: and should the tiller-rope break with no relieving-tackles hooked, or any accident happen to the tiller, the after-yards must be braced up, the fore-sail taken in, and the ship hove-to under the mizen-stay-sail while the mischief is repairing.

To make a Stern-Board.

To make a stern-board, haul down the jib and fore-stay-sail, luff the ship into the wind, and brace sharp aback the yards fore and aft; and when she has stern-way, shift the helm aweather.

Upon Veering under a Main-sail and Fore-stay-sail in a Gale of Wind.

To veer under a main-sail and fore-stay-sail in a gale of wind, watch the ship's falling off, then put the helm aweather, ease off handsomely the main-sheet, and gather forward the lee-main-tack. The wind abaft the beam, let go the main-bow-line, and round in the weather-main-brace. The wind aft, haul down the fore-stay-sail, square the head-yards, brace up the after-yards, and haul on board the

main-tack. The wind upon the quarter, set the mizen-stay-sail, and haul aft the main-sheet. Be careful now to moderate the ship's coming-to, for should she meet a powerful sea with considerable head-way, it may prove extremely destructive. The ship to the wind, haul up the main-bow-line.

REMARKS.

The reason for not squaring the main-yard till the wind is abaft the beam is, that the weather part of the main-sail, when the yard is braced up, being situated before the centre of gravity, acts with considerable force to pay off the ship's head. For making the weather part of the sail of greater service, the following method is sometimes practised. Bend the end of a stout rope to the flings of the main-yard, then lead it down before the main-sail to the top-sail-sheet-bits, and let it be hauled well taught and belayed; thus when the main-sheet is eased off, the weather half of the sail will not lose any of its power to veer the ship. Let a hand stand by the rope to let it go when necessary.

In a very high sea it will be attended with danger to veer under a main-sail only, as by the ship's falling off and not quickly gathering head-way, she is liable to be overtaken by the sea, which may break on board her with considerable violence. In this case the fore-top-sail should be set, which may be taken in when the wind is abaft, or as convenient.

Upon

*Upon checking a Ship round in a Tide's Way with a
Kedge Anchor and Hawser.*

The practice of checking a ship round in a tide's way is more necessary in large ships, which are longer in performing their evolutions, than in small. For this purpose a boat with a kedge anchor and crew should be in readiness to run out a hawser upon either bow, or quarter, as may be required. Let us suppose that a large ship is standing over to the shore under her top-sails, and it is thought there is not room for her to come round in before she will be on shore. In this case, hand the end of the hawser into the boat from the weather quarter, bend it to the anchor, and pay down a good quantity into the boat; then put the ship in stays, and send the boat round the stern to let go the anchor. When the anchor is gone, take a turn with the hawser, and the tide will presently hustle the ship to windward; taughthen the hawser and bring her about: then trip the anchor, unbend the hawser, and haul it on board. Should it be required to veer the ship, let the hawser be handed into the boat from the weather bow, and let the boat be pulled round the bow, and the anchor be dropped to leeward; thus the tide hustling the ship to windward, will taughthen the hawser and veer the ship round, bringing the wind upon the other quarter; then trip the anchor, and haul in the hawser.

Upon drifting to Windward by the Tide.

Where there is not sufficient room to work in a tide's-way, a ship is under the necessity of drifting, the art of which is to keep the ship in the fair-way, and at the same time to manœuvre the sails in such a manner as will least prevent the ship from driving.

If the wind is directly against the tide, and the channel is sufficiently broad, the ship should be drifted broadside to the wind, as the tide will then have the greatest power to drift her; and could the ship be backed astern or shot ahead at pleasure, she might be kept drifting upon the same tack with safety; but it happens, that ships in a tide's way can never be backed so far astern as they will shoot ahead. At the first of a stern-board a ship will go briskly astern, but will soon fall off, and drift with the wind abaft the beam, forging ahead; for this reason she must be drifted with the helm-alee. It follows, as a ship will shoot more ahead than she can be backed astern, that in time she will arrive at the opposite shore, when she must be stayed or veered, and drifted upon the other tack. If she is to be stayed, (which certainly has the preference, as less drift will be lost by it) let the sails be filled in time, to give the ship sufficient head-way to bring her about; then put the helm alee. Should she come about, the sails and helm having now their

proper position for a stern-board upon the other tack, need not be touched till her stern-way ceases, when the helm must be shifted alee ; but should the ship refuse stays, then brace sharp round the head-yards, and box-haul her, by which method she will lose much less drift than by veering.

If the ship now drifting broadside is approaching a narrow channel where it would be dangerous drifting in this position, she must be veered and dropped stemming the tide. In this case, that the drift may be as much as possible, it will be necessary to take in sail, and reduce the ship's head-way till she has only steerage-way left ; thus a vessel may be dropped through a fleet of ships at anchor without danger.

Should the wind be a little across the tide, a ship may be easily drifted in the fair-way, with her head towards the weather shore ; for thus it will be found that she can be backed and filled at pleasure, and generally be drifted with the sails shivering, in which position they oppose least power to prevent the drift.

It frequently happens in serpentine rivers that the tide sets across, in this case the ship must be drifted with her head to the side from which the tide sets. These sets are best discovered by observing the opening or shutting of two objects in the direction of the channel.

Upon

Upon Trimming the Sails.

It is necessary all sails should be trimmed, to stand as taught as possible. The more a sail is made to approach a flat surface, either by or before the wind, the better: the notion that there should be a reef of slack canvass let out when sailing large is ridiculous. It is likewise necessary the sails should be so balanced fore and aft, that the helm may be carried amidships, for nothing can be more absurd than a ship's carrying a large driver booming over her taffarel, with a turn and a half of weather helm. If the helm cannot be eased by setting head sail, the driver should be taken in, when she will be more under command and sail faster; for the force of the water against the rudder in the direction of the stern, is greater than the direct effort of the driver, which obliges it to be kept in that position; therefore by taking the driver in, and thus suffering the ship to carry her helm amidships, she certainly will sail with greater velocity. The sails that will most tend to counteract the driver, when the wind is abaft the beam, are the lower and top-mast-studding-sails set forward: these sails standing out considerably from the ship, act with a length of lever to pay off the ship's head.

It has been demonstrated that whatever angle the wind may make with a vessel's head, to gain the greatest

greatest velocity of sailing, this angle must be so divided by the yard that the tangent of the angle between the wind and the yard may be double the tangent of the angle formed by the yard and the vessel's head; though, this rule becomes useless to three masted vessels when the wind is more than a point abaft the beam, for then the after-sails would obstruct the wind's filling the head-sails. But when the wind is upon or before the beam, if the yards be so braced that the angles between the wind and the yards may be a point and three quarters greater than the angles formed by the yards and the ship's head, then they will be trimmed nearly according to the foregoing demonstration. Though it may be difficult in practice to exactly follow this rule, yet always be careful that the absolute angles between the wind and the yards may be more open than the angles between the yards and the ship's head, that the sails may not be kept touching the wind.

If the wind is abaft the beam the after-yards should be braced more up than the head-yards, that the wind may fill the head-sails,

REMARKS.

The yards of ships do not brace up sufficiently sharp to sail only six points from the wind with the greatest velocity, for in this case the yard should be braced up to make an angle with the ship's head of 25 degrees only, instead of which they generally make

make an angle of 35 degrees. If the fore-mast-shrowds were catharpined into straps round the mast, and the shrowds altogether gradually catharpined in more forward than aft, the yards might be braced up to make a less acute angle with the keel.

On board a vessel sailing obliquely to the wind, a vane does not shew the absolute direction of the wind, but a direction compounded of the vessel's way and the velocity of the wind. By the vane, a ship will appear to be lying about four and a half, or five points from the wind, but if she is put about it will probably be found that the two courses differ by thirteen points, which shews that the ship was six and a half points from the wind, when by the vane it appeared to be about five.

As the action of a sail is perpendicular to its surface, the jib and most of the stay-sails must be rising sails; therefore the jib instead of tending to make the ship pitch, on the contrary will prevent it.

If the masts are upright, all the square sails act horizontally, and while their centre of effort is the same height with the point velique, they will not tend to force the ship from her parallelism; but if the fore-mast is stayed forward, which is often a practice, the head-sails will depress the ship; and if the mizen-mast is stayed aft, the square sails set upon it will rise the stern, and still more depress the bow. From which reasoning it appears that all masts should be erect, which certainly has a more
beautiful

beautiful appearance than to see one mast falling over the taffarel, and another tumbling over the bows.

It does not always follow that a ship will fail the faster for setting more sail. For instance, let us suppose that a ship in good trim is gliding along perfectly easy at as great a velocity as she is accustomed to sail with, and that the centre of effort of her sails meets the point velique. Now, after this, if another sail should be added, either above or below the point velique, the centre of effort will no longer meet it, and of course the trim of the ship will be altered for the worse.

Upon Sailing against a Sea.

Making sail against a head-sea is attended with considerable danger, particularly if the sea be short; thus when one sea has passed abaft a vessel's midships and depressed her head, she will be met by a second before her head has risen, which will shock and pass over her with a force expressed by the square of the united velocities of the ship and sea: therefore by reducing the head-way, it will diminish the power of the waves. If this be accomplished by taking in the square sails forward, it will also prevent her pitching so deep in the sea.

It is a custom when a sea is seen coming upon the bow to put the helm down, and thus cause the ship
to

to meet it: the reason for this practice does not appear clear, as it is not attended with any particular advantages. If the sea is nearly ahead, to luff the vessel to it cannot be attended with any disadvantage; but if a towering sea is observed coming upon the beam, it would be the height of imprudence to put the helm down; rather put it up, and thus diminish the force of the wave by running from it.

C H A P. III.

Upon coming to an Anchor.

WHEN a ship is coming to an anchor she should always be under easy sail; as the top-sails, jib, and fore-stay-sail, mizen, and mizen-stay-sail.

To bring a Ship to an Anchor upon a Wind where there is no Current.

To bring a ship to an anchor upon a wind where there is no current, let her be kept on under easy sail, till within a few ships length of her anchoring birth; then put the helm alee, haul down the jib and fore-stay-sail, clew up the fore and main-top-sail, and throw the mizen-top-sail sharp aback to the mast. When she has stern-way let go the anchor, right the helm, and give the ship the necessary cable; then send the hands up to furl the sails.

To

To come to an Anchor with the Wind large.

To bring a ship to an anchor with the wind large, is performed nearly in the same manner as the foregoing evolution; though the main-top-sail had better be taken in, as the ship will have sufficient head-way under the fore and mizen-top-sails. Let the ship be steered a little to leeward of the birth intended to be brought up in: when to leeward, haul down the jib and fore-stay-sail; put the helm alee; brace sharp aback the mizen-top-sail-yard; haul out the mizen; and when the fore-top-sail shakes let it be clewed up. If this manœuvre is performed with judgment, the ship will just fore-reach her birth; which when she has dropped into, let go the anchor.

If the wind is right aft, it will be necessary to steer to one side of the anchoring birth, to give room for the ship's shooting in bringing to the wind; and if it blows hard the fore-top-sail should be taken in before she is brought to an anchor.

To come to an Anchor without Tending.

It sometimes happens, that a ship is to be brought up in a place where there is not sufficient room to tend her. In this case reduce her head-way as much as possible, before she comes to her anchoring birth.

To

To come to an Anchor upon a Weather and Lee-tide.

To come to an anchor upon a weather-tide, the ship should be so steered as to be brought to her anchoring birth stemming the tide, and shot ahead of her anchor. Upon a lee-tide, she must be brought to an anchor upon that tack which will most admit of her head's coming to the tide; and should it blow hard, it will be necessary to furl the square sails, and bring the ship to an anchor under the stay-sails.

To let go all the Anchors to the best Advantage.

When it is found that a ship cannot clear the shore under her lee by failing, owing to the strength of the wind and the height of the sea, the last resource is to come to an anchor with all the anchors in the best position. For this purpose, let the cables that are bent be got clear for running. Then furl all the square sails with as much expedition as possible, and shoot the ship along the shore under the stay-sails. When the square sails are furled, let go the weathermost anchor, and veer away briskly the cable; then let go the next weathermost, and so on till all the anchors are gone, nearly in a line along the shore; thus when the ship becomes wind-road, all the cables may be made to bear an equal strain, and are separated from each other.

C H A P. IV.

Of keeping a clear Anchor.

THE art of keeping a clear anchor is thought to be a difficult branch of seamanship, but I believe only from its being so seldom practised by the generality of seamen, particularly by those who sail long voyages; these seamen not being often in a tide's-way at single anchor without having a pilot on board, whose duty it is to tend the ship at high and low water.

Upon the Nature of Sheering a Vessel to one Side of her Anchor.

If the side of a ship at anchor is presented to the tide by any means, the water will act upon her two ways, one in the direction of her keel, the other in the direction of her beam, which last will cause her to sheer out to one side of her anchor, which before was ahead. Suppose, for example, the power that presents the ship's side to the tide was a spring from the anchor coming in aft on the starboard side; upon heaving in the spring, the ship will sheer over to port, bringing the anchor upon the starboard bow. The more the spring is hove in, the more the ship will go ahead and over to port, till her side

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makes

makes an angle with the tide of 45 degrees, when she will be the farthest over from her anchor that she can go; and if the spring is hove in after this, the ship will return, and be in the stream of her anchor when she is hove round broadside to the tide. Now, if the helm is put over to starboard, it will act the part of the spring, by forcing the ship's stern to starboard, and thus by causing the water to act upon her starboard side, the ship will be forced over to port: and if the helm had been put aport, the larboard side would be presented to the action of the water, and the ship would go over to starboard: but the power of the rudder being according to the strength of the tide, which action lessens upon the rudder as the ship sheers obliquely to the stream, it can never produce so great an effect as the spring.

REMARKS.

It should be a practice to shoot a ship, if it can possibly be done, on the same side of her anchor each tide, that the danger arising from the anchors not turning as the ship swings may be avoided; for should the anchor not turn in the ground, the cable will get foul about the upper fluke or stock, and either trip it out of the ground, or damage the cable. It often happens, when an anchor is tripped out of stiff ground, that it will not take hold a second time without the upper fluke should cant down,

down, for the quantity of clay that adheres to the fluke prevents its digging into the ground afresh, so the anchor keeps tripping over the surface, and another anchor must be let go before the ship can be brought up. As a ship by being sheered presents one bow to the tide, if the wind is directly against the tide it must blow upon the opposite quarter.

To Tend a Ship for a Weather-tide.

Let us suppose a ship riding at single anchor upon a lee-tide, with the wind in the direction of the tide, and that it is required, upon the tide's setting to windward, to tend the ship clear of her anchor. For this purpose, when the weather-tide sets, and brings the wind broad upon either bow, hoist the jib and fore-stay-sail, and brace full the yards, to shoot the ship a taught cable from her anchor; then put the helm alee, and wait till the buoy comes upon the same side that the helm is put over to; after which, brace to the head-yard, and keep the after-yards full to assist the helm. If the buoy bears nearly abeam, the jib and fore-stay-sail may be hauled down; but if the wind blows fresh, and shoots the ship nearly end on with the cable, bringing the buoy upon the quarter, it will be necessary to keep the fore-stay-sail up, as in this situation the ship will be in danger of breaking her

sheer against the helm, and the fore-stay-sail will be in readiness to catch her before she can fall to windward of her anchor. As the weather-tide slackens, the ship will gradually fall wind-road, when haul down the fore-stay-sail and right the helm; and should it blow fresh, let the yards be braced forward, and the ship be given the necessary cable.

To Tend a Ship with the Wind a few Points across the Tide.

Let us suppose a ship riding lee-tide with the wind two or three points upon the bow is to be cast for a weather-tide. When the tide is done, the ship will become wind-road, and of course must cast with her head to the weather shore. As the lee-tide makes, and brings the wind on either side, put the helm alee; hoist the jib and fore-stay-sail with the sheets to windward; brace aback the head-yard, and fill the after-yards. When the ship has sheered taught to windward of her anchor, haul down the jib and fore-stay-sail, and as the wind is broad upon the quarter, she will lay perfectly quiet the remainder of the tide. As the weather-tide slackens, the ship will shoot end on with the cable, bringing the buoy upon the weather quarter. When the wind is abeam, if it is thought necessary, the jib and fore-stay-sail should be hoisted to force the ship a taught cable from her anchor; which

which let be hauled down when they shake. Should it blow fresh, let the ship be given the necessary cable before the lee-tide makes, and let the yards be pointed to the wind.

To Tend a Ship with the Wind across the Tide.

When the wind is across the tide, the simplest method of tending a ship is to keep her both tides to leeward of her anchor. At each slack water the ship will become wind-road, and as she tends, and brings the wind on either side, put the helm aweather, and hoist the fore-stay-sail with the sheet to windward, to force the ship a taught cable from her anchor. When the tide is set, and the ship upon a proper sheer to leeward of her anchor, the fore-stay-sail may be hauled down.

Of keeping a clear Anchor in Calm Weather.

In calm weather when assistance cannot be given to a ship by sail to keep the cable clear of her anchor, but she is in danger of falling over it, or on the wrong side; then, before slack water, let the cable be shortened in apeak to prevent it from getting foul of the anchor.

REMARKS.

It should be remembered that it is not always necessary to put the helm hard over, for by this means, in a strong tide, a ship may be sheered adrift, but to adapt the helm to circumstances.

It will not be always necessary to make use of the yards in tending the ship to shoot her a taught cable from her anchor. In general the jib, fore-stay-sail, and main-top-mast-stay-sail will be quite sufficient for this purpose. Should the wind shift at any time, it will be necessary to alter the sheer of the vessel accordingly.

If there is the least suspicion of the ship's having come near her anchor, it should be sighted the first opportunity.

There are roadsteads where an anchor will so completely bury itself, that the bight of the cable can never foul it. In such places it would be better, should there be room, to lay at single anchor than to moor.

In a tide's way, at single anchor, a second anchor should never be let go, but when absolutely necessary; for with a long scope of cable, a ship will ride more easy than with a shorter scope upon two cables. Should a vessel happen to drift athwart hawse in a gale of wind, there will be only one cable to cut; but how dreadful is the situation of
that

that vessel which has cut from two anchors, and probably not another remaining at her bow!

If your ship should be in the hawse of another, it will then be necessary to drop a second anchor under foot.

When riding in a gale of wind, the deep sea-lead should be overboard, and often attended, that the officer may be assured the ship rides fast.

C H A P. V.

Upon Mooring.

It should be a rule to moor in a roadstead with the best cable and anchor to that quarter where the strongest wind and the highest sea are expected from; but in rivers, or in a tide's-way, where freshes are expected, the best anchor and cable should be layed to the ebb.

To Moor in a Tide's-way.

Let us suppose a ship is about to be brought up at high water, and it is intended to moor with the best bower to the ebb. In that case, she should be brought up with the best bower, and the cable stoppered till the ebb makes strong; then veer away two cables, and, if it can be done, assist her astern

with the mizen-top-sail. If, when the two cables are out, and the ship in the stream of her anchor, it is thought when moored she will ride too near any particular vessel, sheer her over from that vessel, and let go the small bower anchor. Now ship the capstern bars; bring-to the best bower; veer away the small bower; and heave in the best bower to the whole cable service; then stopper the cables and bit them, remembering to leave sufficient service within board to freshen hawse,

To Moor with an open Hawse to any particular Quarter.

To moor with an open hawse to any particular quarter, let us suppose, for example, the roadstead, or river that the ship is to be moored in, to lie north and south, (in which direction the anchors are to be layed) and that she carries her best bower on the larboard side; and it be requested that when moored, the ship shall swing with an open hawse to the eastward. In this case the best bower must be the northern anchor; but if the hawse had been required to be open where her head was swung to the westward, the best bower must have been the southern anchor.

Of keeping a clear Hawse.

When a ship is moored, many officers think themselves in so perfect a state of safety, or their minds are

are so much employed about the taking in or delivering the cargo, that the keeping the hawse clear is too much neglected.

If the hawse is clear, the ship must ever swing with her stern to the side the headmost cable leads of: if she swings contrary to this, she will make a cross: if she swings a second time wrong she will make an elbow; and a third time will make a round turn, in which situation it will be impossible either to heave in or veer away cable, let the case be ever so urgent.

If, to keep the hawse clear, the ship should swing with her stern to windward, it will be impracticable to get her the right way by any sail that can be set; for as the tide slackens she will naturally fall wind-road, and when the tide sets, it will take her upon the wrong side: however, if the wind continues, she cannot foul her hawse any more, as at the next tide the same wind will undo the cross it caused. When the wind is either ahead or astern, by the assistance of the mizen-top-sail or jib the ship can generally be made to swing the right way. For example, let us suppose the wind ahead, or even a little upon the starboard bow, and that the ship's stern is to swing to starboard. In this case, set the mizen-top-sail with the starboard yard-arms braced forward; haul up the starboard bow-line; and hoist the jib, with the sheet to windward; then, before the lee-tide is done, put the helm to starboard

board to give the ship a sheer, which will be preserved by the position of the sails. Now watch the tide, and at slack water shift the helm: thus, when the tide makes, it will act against the larboard side of the rudder and stern, and very much assist to swing the ship the right way. Again, should the wind be aft and a little upon the wrong quarter, if the helm be attended as before directed, and the mizen-top-sail braced full the right way, in all probability the ship will swing as required.

However, should this attending to the sails break the people too much off from their necessary harbour duty, if the helm only was properly regarded, it would often save the labour of clearing the hawse.

REMARK.

It would be proper at all times to have a rope and small anchor in readiness abaft, to run out and haul the ship round in calm weather.

Upon clearing Hawse.

Clearing hawse can only be attempted when the ship does not ride by the clearing cable. To execute it, bend a fish-hook to the fore-bow-line, hook this to the cable the ship is riding by, below the turns in the hawse, and bowse it well up out of the water; then lash the cables together below the
turns,

turns. If the cable by which the hawse is cleared leads on the starboard side, send the larboard fore-top-bow-line into the hawse-hole under the cable; or under and over, according as the cable to clear with is either below or above the other, which must be bent about three fathom within the hawse. Then send in the starboard bow-line, which let be bent well in towards the end of the cable, and stopped along the cable at about every fathom; and let a hawse-rope be bent to the end of the cable. When all the bowlines are fast, unbit the cable, and haul out upon the starboard bowline; let a hand cut the stops as the cable comes out of the hawse; and when a long bight is out, haul upon the larboard bow-line, and trice this bight up to the bow-sprit. Should this one bight not sufficiently expend the cable, that its end may be taken round the other, hang it to the bow-sprit, and send down the larboard bow-line for a second bight. When the end of the cable is round the other, shift the hawse-rope and haul it in again. If the hawse is now clear, bit the cable and unlash, otherwise the end must go out again, and be passed round the cable the ship is riding by, till the hawse is perfectly clear.

REMARKS.

Should it blow fresh, and the tide run to windward, it may prove dangerous trusting to the lashings

lashings alone, lest the cable should run out end for end. In this case, bend a hawser with a rolling hitch to the clearing cable below the turns in the hawse, and let it be hove well taught as a double security.

If the weather is moderate, and the tide easy, the hawse may be readily cleared by bowfing the headmoft cable well up out of the water, and bending to it a hawser, from the hawse, below the turns. Then unbit the cable, veer away upon the hawser, and stick the headmoft cable round the other till its end is clear; when, heave in upon the hawser, take in the cable again, and bit it. Should it come on to blow a gale of wind when a ship is moored, from that quarter which will oblige her to ride equally by each cable, and the hawse is clear, it will be necessary to splice a second cable to the small bower, and to veer away equally upon both cables; but should the hawse be foul, and it is expected that the cables will damage each other, then bend a hawser below the turns in the hawse, to the small bower, which slip, and let the ship swing to the best bower. When the weather moderates, heave in the end of the small bower, and the ship will be moored as before, with a clear hawse.

To Unmoor a Ship.

Suppose the ship to be unmoored had her best bower to the ebb, in that case let her be unmoored upon the ebb tide; but was there any necessity for unmooring upon the flood, the stream cable must be spliced to the small bower. To unmoor upon the ebb, when it has made strong, veer away the best bower, bring-to and heave in the small bower, and keep veering away the best, till the small bower is up and down; then stopper the best bower. The small bower up, cat the anchor, shift the messenger, bring-to the best bower, and heave in to the whole or half cable service, as may be thought necessary; then bit the cable, and fish the small bower anchor.

REMARK.

Should a ship be under the necessity of unmooring upon a windward tide with a strong wind, it will be extremely difficult and dangerous to take up the sternmost anchor. In this case, if there are no ships in the way, the headmost anchor may be taken up first with safety, and the sternmost cable be hove in towards slack water.

To present a Ship's Side to an Object a-head, when either Wind or Tide-road.

To present a ship's side to an object a-head when either wind or tide-road, let a hawser be passed from aft, on the side that is to be shewn to the object, and bent to the headmost cable with a rolling hitch. Then by veering away the cable, and holding on the hawser, the ship's stern may be brought round to any required degree. The hawser in this case is called a spring; and it often happens that a spring on each side will be necessary to present either side to the object at pleasure.

C H A P. VI.

Upon getting Under-way.

To cast a Ship, riding Head to Wind, in a Place where there is no Tide.

To cast a ship, riding head to wind, in a place where there is no tide, let the cable be hove in short; send hands up to loose the top-sails, which let be sheeted home and hoisted; and if it is required to cast the ship upon the starboard tack, brace up the head-yards with the starboard braces, and the
after-

after-yards with the larboard braces; then put the helm to port, and send the hands to the capstern, to heave up briskly the anchor. When the anchor quits the ground, the ship by the assistance of the helm and sails will pay round to port; then hoist the jib and fore-stay-sail to help her. The anchor to the bow, fill the head yards, keep the ship her course, and trim and make sail as required.

REMARK.

Should the wind blow fresh, it will be proper to cat the anchor before the head-sails are filled.

To cast a Ship when Tide-Road with the Wind a-head.

To cast a ship when tide-road with the wind a-head, the same practice must be followed with the sails as to cast a ship when wind-road and no current; but the *helm* must be put the contrary way, for now the effect of the helm is by the tide's passing her, which in the former case was by the ship's stern-way.

Upon getting a Ship Under-way with a leading Wind in a Tide's-way.

If the ship to be got under-way has a leading wind, and is in the midst of a number of vessels,

or

or in a narrow channel where it would be difficult to cast her upon the lee-tide, she should be got under-way before the weather-tide is done. Thus the casting of the ship will be avoided, and she may be steered through the channel, or fleet, with safety.

REMARK.

Should it blow so fresh upon the windward tide as to force the ship end on with her cable, it will be impossible to heave it in without sheering the ship over from side to side, and heaving in briskly as the ship slack the cable; but as this is attended with considerable danger by the sudden bringing up of the ship upon each sheer, it will be prudent to heave apeak upon the first setting of the windward tide, before the ship swings, to bring the wind aft.

To cast a Ship from her Anchor, upon a Lee-tide, and back her Astern clear of Danger.

To cast a ship from her anchor, upon a lee-tide, and back her astern clear of danger, upon the starboard tack, let the cable be hove in apeak; then set the three top-sails braced up with the starboard braces, and put the helm to starboard. Now heave up the anchor, and as it quits the ground, by the effect of the helm the ship will cast, bringing the wind upon the starboard

board bow. While the anchor is coming up from the bottom, the ship will keep to the wind and back astern extremely well; and by the time the anchor is hove up to the bows, it may be supposed the ship has backed clear of the danger; when, run up the jib and fore-stay-fail, fill the head-fails, and shiver the after-fails, as she will have no head-way, and the ship will veer round in little room.

Was a stern-board required to be made upon the same tack, and no tide, the same practice is to be followed with the *sails*; but the *belm* must be put aport, as now its effect is to be produced by the ship's stern-way, which in the former case was by the tide's passing her.

REMARK.

It must be remembered, that a ship will not readily veer till the anchor is close up to the bow, therefore when a ship is to be got under-way from deep water and a narrow channel, it is best to make a stern-board from her anchor, which will back her over to the shore astern by the time the anchor is up, and give her room to veer round.

CH A P. VII.

Upon setting, and taking in several Sails in blowing Weather.

To set a Main-Sail in a Gale of Wind.

To set a main-sail in a gale of wind, before the sail is loosed let the double block of a tackle be made fast to the weather-clew, and the single block be hooked low down upon the chestree, and the fall led aft. Now, man well the main-tack and fall at the same time, and when the sail is loosed ease away the weather-clew-garnet, let go the bunt-lines and leech-lines, bowse down upon the tackle and take in the main-tack: the main-tack down, haul aft the sheet, brace up the yard, and haul the main-bow-line.

REMARK.

A fore-sail is set after the same manner as a main-sail; but as the fore-tacks generally lead double, they are a sufficient purchase without the aid of a tackle to the weather-clew.

To set a Top-Sail in a Gale of Wind.

To set a top-sail in a gale of wind, a tackle should always be in readiness to clap on either sheet,

may be required. First man the lee-sheet; and the sail being loosed, ease down the bunt-lines and weather clew-line; and haul home the lee-sheet; then haul home the weather-sheet, hoist the sail, and brace up as required.

REMARK.

Should the wind be quartering, the lower and top-sail yards should be braced well into the wind, before the sail is sheeted home.

To take in a Course, in a Gale of Wind.

To take in a course, in a gale of wind, man well the weather-clew-garnet, ease off the tack and bow-line; and run it up; then man the lee-clew-garnet, bunt-lines, leech-lines, and weather-brace, and being all ready, ease away the sheet, haul up the clew-garnet, bunt-lines, and leech-lines, and round in the weather-brace, till the yard is pointed to the wind. Now haul taught the trusses, braces, lifts and rolling-tackle, and send the hands up to furl the sail.

To take in a Top-Sail, in a Gale of Wind.

Upon taking in a top-sail, in a gale of wind, nautical men are much divided; some approve clewing up to windward first, and others to leeward.

If the weather side is to be clewed up first, the weather-brace must be rounded well in, and the yard got close down upon the lifts, otherwise the lee-rigging will be in danger of being carried away by the great pressure of the lee-yard-arm. If the weather-brace can be rounded well in, and the yard be got close down, it will be best to clew up to windward first, for thus the sail may be taken in without a shake; but if the weather-brace cannot be hauled in to ease the yard off the lee-rigging, recourse must be had to clewing up to leeward first. In this case, it will be best, if hands can be spared, to man both the clew-lines, bunt-lines and weather-brace at the same time; thus, when the lee-sheet is eased off, the weather-brace may be hauled in with ease, and the yard laid to the wind; and when the lee-clew-line is half up, ease off the weather-sheet, and run up the weather-clew-line; then haul taught the lee-brace, bowse taught the rolling-tackle, and send the hands up to furl the sail.

To take in a Jib, when blowing Fresh.

To take in a jib, when blowing fresh, man well the down-haul, let go the haliards, ease off the sheet, and haul down briskly; and when the sail is close down, ease away the out-haul, and haul the sail in to the bow-sprit cap; then let it be stowed away in the fore-stay-sail netting.

To haul in a Lower-studding-sail, blowing Fresh.

To haul in a lower-studding-sail, blowing fresh, lead one of the sheets aft clear, and man it well; then lower away briskly the outer-haliards, to spill the sail; ease off the tack, run in upon the sheet, and lower away the inner-haliards as required.

To haul down a Top-mast Studding-sail, blowing Fresh.

To haul down a top-mast studding-sail, blowing fresh, man well the deck-sheet and down-haul; ease off the yard-sheet, and haul the yard close out to the tack block; then ease away the tack, and haul down both upon the deck-sheet and down-haul.

To brail up and haul down a Main-top-mast Stay-sail, blowing Fresh.

To brail up and haul down a main-top-mast stay-sail, blowing fresh, man well the lee-brail and down-haul, having a few hands to gather in the slack of the weather-brail; then let go the haliards, ease off the sheet, and haul down and brail up as briskly as possible. When the sail is down, let go the tack, and stop the sail over to the lee-fore-rigging.

To brail up a Mizzen, blowing Fresh,

To brail up a mizen, blowing fresh, man well the lee-brails, particularly the throat-brails, which should have a whip purchase; ease off the mizen-sheet, and brail up briskly, taking in at the same time the slack of the weather-brail. After the sail is hauled up, stop its foot by passing the gasket round to leeward, which will spill it.

To take in a Top-gallant-sail, blowing Fresh.

To take in a top-gallant-sail, blowing fresh, the lee-sheet must be started first; for if the weather-sheet is first eased off, the yard will fly fore and aft.

To bend a Course.

To bend a course, stretch the sail athwart the deck, the starboard side of the sail to the starboard side, the larboard to the larboard side; then bend yard-ropes to the earing-cringles, and make fast the head-earings a few feet up upon the yard-ropes. The bunt-lines, leech-lines, clew-garnets, and all the geer bent, make fast a rope-band to each bunt-line and leech-line leg, that the men may be enabled to catch the head of the sail from the yard. Now man well the yard-rops, bunt-lines, leech-lines, and clew-garnets, and run the sail up to the yard,

yard. The sail aloft, send the hands up to bring it to, and let them haul out the weather-earing first, then the lee; and if it is a new sail, let them ride the head-rope to stretch it. The sail being hauled square out upon the yard, make fast the rope-bands, keeping the head of the sail well upon the yard.

To bend a Top-Sail.

To bend a top-sail, overhaul the leeches of the sail, put in the earings, bend the bow-line legs, lay out the clews, and open them if necessary, and make the sail up snug again; then round down upon the lee-top-sail-haliards till the weather fly-block is high enough to bring the sail up over the guard-iron, when rack the tye over to the weather-rigging. Now pile the sail up upon slings, with the lee side uppermost; hook on the top-sail-haliards, and run the top-sail up into the top; then stretch the sail round the fore part of the top, bend the geer, and make fast the head earings a few feet up upon the reef-tackle-pendants, with a rope-band or two to each bunt-line leg. The geer being bent, man the reef-tackles, bunt-lines, and clew-lines, and haul out the sail. Now let the hands lay out upon the yard, and haul out the weather-earing first; then haul out to leeward, and ease off to windward till the sail is square, when make fast

the rope-bands, keeping the head of the sail well up upon the yard.

To unbend a Course, in a Gale of Wind.

To unbend a course, in a gale of wind, first furl the sail, then cast off the rope-bands, and make them fast round the sail, clear of the gaskets. When the rope-bands are all off, ease off the lee-earring, and lower down the sail; and when the people upon deck have got hold of the lee part of the sail, ease away the weather-earring.

To unbend a Top-Sail in a Gale of Wind.

To unbend a top-sail in a gale of wind, first cast off the points of the reefs, keeping fast the earings; then furl the sail, and cast off the rope-bands, which make fast round the sail, clear of the gaskets. After this cast off the lee-earings, and haul the lee side of the sail into the top; then haul in the weather side. Now unbend the reef-tackle pendants, bunt-lines, and bow-lines; bight the sail snugly up together; and send it down by the clew-lines to windward or leeward, as most convenient,

C H A P. VIII.

*Respecting Cables, Nippers and Stoppers.**Upon coiling Cables.*

ALL cables should be coiled the way they lie, or the way they run round the windlas, and their tiers should be on the side opposite to that on which they lead. The best bower, which is mostly the working cable, should lead foremost up the hatchway; then the small bower; and abaft all, the sheet, which being the least wanted can be triced snug round the after part of the hatchway, out of the way. Should your new cables come immediately from the rope-walk, let them be coiled down into the craft that is to bring them on board, the same way they are to be coiled on board.

A cable generally kinks from more turns being forced into it by the coiling than it naturally had, and the only way to get rid of these kinks, is to coil the cable across the hatchway from side to side, in large fakes, with the sun; then take the upper end through the coil, and coil the cable down in the tier the way required. By this means, as many turns will be taken out of the cable as there are fakes coiled round the hatchway,

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It should be a rule in coiling cables never to lay out near the hatchway, but to keep that part of the tier as low as possible, that the bends may have sufficient room to upset.

Were all store cables first coiled down from the rope-walk against the sun, they would be better adapted to coil on either side of a ship; for a cable coiled against the sun will more easily reverse, and have less kinks in it than a cable coiled with the sun.

On splicing Cables.

The suggest and best method of splicing a cable is to put the ends in twice each way; then to pick out the strands, and worm part of them round the cable, and taper away the rest, which let be snugly marled down. After this let there be clapped on a good throat, and two end-seizings of six thread rattling.

The strands of the small bower and stream cable had better be pointed, that these cables may be more briskly spliced in case of necessity.

Upon serving Cables.

Cables should be served against the lay. The most expeditious way of clapping on rounding is with a top, when there is room to work it, otherwise, recourse must be had to beating it on with mallets,

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mallets. Be careful to let the service be stopped with spun-yarn every six or eight turns.

Mooring services are generally clapped on about fifteen fathoms from the end, or splice of the cable; and large vessels should have about twelve or fourteen fathoms of service, half of it rounding and plat, and the rest keeling. Upon the working cable, there should be a short service of eight or ten fathom at the half cable.

Mats, made the width of the round of the cable, and about three fathoms long, are very convenient to have at hand, to lace on the cable with expedition in cases of necessity.

Of an approved Dog-stopper.

An approved form for a dog-stopper is to have it made with a large eye, that it may be thrown over the bit-head, and shifted over from side to side at pleasure.

Of an approved Bit-stopper.

An approved form for a bit-stopper is to have it about four fathoms long, and tailed out, nipper fashion, at one end, and knotted at the other: let this stopper be rove through the hole in the knee before the main-bits. To pass it, let it be led aft, inside over the cable, and under the bits outside the cable; then worm it round the cable before the bits. Now

as the cable runs out, and it is required to check the ship, haul taught the worming, and by the cable's drawing forward it will tighten the stopper, and bind the cable so close to the bits as effectually to bring the ship up. From the nature of this stopper it is not likely to jamb, therefore is extremely well calculated for bringing a ship up with ease, as by slackening or hauling taught the worming, the cable may be suffered to run out or be checked at pleasure.

In heaving up in a sea, when by a sudden pitch of the ship the messenger or nippers give way, this kind of stopper will be found extremely serviceable, for upon these occasions, this stopper may be always passed ready, and the bight triced up abaft the bits with a rope-yarn, clear of the cable.

Upon Ring-Ropes,

Ring-ropes are better single than double; for when single they are passed with less confusion of turns. To pass a single ring-rope, and have it in readiness to check upon veering away cable, take three slack turns through the ring and round the cable, one before the other, and let a hand hold up the parts fair; then take as many slack turns of worming round the cable, before the ring, which let be held up fair by another hand, giving sufficient room for the cable to pass through. Now, when
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it is necessary to check the cable, haul taught the worming, and by the cable's going out it will presently draw those turns taught which were taken through the ring, and bind the cable so close to the ring, as to prove an excellent stopper.

REMARK.

A mast stopper is of little service, unless it be long enough to clap on above the combings.

Upon Nippers, and the Manner of clapping on a Racking Nipper.

The usual method of clapping on a nipper, with a round turn round the messenger and another round the cable, is an exceeding good one, and very suitable to quick heaving; but when a strain is to be hove, and the cable is muddy, the nippers clapped on after this method will not bite, and recourse is generally had to hitching the messenger, a very bad practice, which justly deserves to be reprobated, as in the nip it materially damages both cable and messenger. In this case throw sand or ashes upon the cable, and take a long dry nipper, which middle and pass one half aft, racking it in and out round the cable and messenger; then worm its end round the messenger only. After this, pass the other half in the same manner forward, but worm its end round the cable only, and let a hand hold on each end of
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the nipper. Now the advantage of this method is, that by the cable's drawing forward, and the messenger aft, the nipper will be drawn so taught as effectually to hold the cable till something gives way: another advantage is, that they can never jamb; for both ends are clear for taking off.

CHAP. IX.

Upon Purchases, and Friction.

It is extremely necessary that every seaman should be so far acquainted with the mechanical powers, as to be able to calculate the force of those purchases he is continually applying.

Upon the Crow, Handspec and Capstern-bar.

The crow, handspec and capstern-bar are all levers of the same kind, differing only in their power by the difference of their lengths from each respective prop, or fulcrum.

Let us suppose AB, fig. 12, to be a handspec or crow eleven feet long, and for the purpose of prising up a weight is rested upon the prop C at one foot from A, and the weight applied to the end A being ten hundred weight, it is required to know what power

power must be applied at the end of the handsped B to raise the weight at A. For this purpose, multiply the weight applied at A by the distance AC, and it will give the momentum of the weight. Now it is clear that the momentum on the other side of the prop must be made equal to this, before the weight at A can be even balanced, therefore let the distance CB be multiplied by some power that will make the momentum at B equal to the momentum at A, then that power will be the quantity necessary to raise the weight at A. Thus in the present case, the weight at A of ten, multiplied by the distance AC of one, gives ten for the momentum at A; and if the distance CB of ten be multiplied by one it will give ten for the momentum at B; therefore one hundred must be the power applied at B to balance the weight at A; and to raise it higher, a little more power must be added to overcome the friction. Again, let us suppose AB to be a capstern-bar, and that the circle represents the barrel of a capstern turning on the centre C, which in this case is the prop. Now, if it is required to know what power at the end of the bar B will purchase the weight at A, it must be gained as in the former case. Thus let the weight be multiplied by half the diameter of the barrel, to give the momentum of the weight, which same momentum must be gained on the other side of the centre, by multiplying the distance BC by some power

power which will make the momentum on this side equal to the momentum on the other,—which will be the power required.

Thus considered, the power of a capstern or windlas, is nothing more than the united powers of a number of levers: but it must be remembered, that as the capstern turns round upon a very large spindle, it is subject to a considerable degree of friction.

Upon a Whip-Purchase.

The better to conceive the power of a simple whip-purchase, let us ask the question—if a person were to haul a hundred weight into a ship's top by these means, what part of it would rest upon his hands? Let the block composing the whip be made fast to the weight, and let the standing part of the whip-fall be made fast to the top rim. Now, let the person in the top weigh the weight off the deck, and then let him consider what part of it rests upon his hands:—the weight hangs by two ropes which are equally taught, consequently each rope bears the same quantity of the weight, but together both ropes bear only a hundred weight; therefore each rope separately must bear fifty, and as the person holds one of the ropes, fifty weight must be the quantity resting upon his hands.

Upon

Upon a Tackle.

A tackle is a convenient kind of purchase, but subject to much friction. Its power will be, friction not considered, as the number of parts of the fall that are applied to sustain the weight. If the tackle consists of a double and a single block, there will be four parts of the fall, and if the weight to be hoisted up, be hung to the double block, it will rest upon four ropes, which are each equally stretched; therefore each must bear the same part of the weight. Now let us suppose the weight hung to the double block to be four hundred, then one hundred applied to the hauling part of the fall will suspend it; and if as much more power be applied as will overcome the friction, it will purchase the weight: but had the weight been hooked on to the single block, it would have rested by three ropes only, each of which would bear a third; therefore a third of the weight being applied to the hoisting part of the fall, would suspend the weight when hooked to the single block; and as much more power being applied as would overcome the friction of the tackle, would purchase the weight.

Of a Whip upon a Whip.

The greatest purchase that can be gained by blocks is by having a whip upon a whip, that is, the

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fixing

fixing one whip upon another whip-fall. Thus two single blocks will afford the same purchase as a tackle having a double and single block, and with considerably less friction. This purchase should certainly be used whenever the length of the hoist will admit of it. To top-sail, and top-gallant-yards that hoist up with a single tye, there will be sufficient room to apply this purchase as haliards, which will overhaul with great facility.

Upon the Purchase gained by Swigging off.

What is called swigging off, that is, pulling at right angles to a rope, is at first a very great power, but it decreases as the rope is pulled out of the straight line. This purchase depends upon the resolution of forces, and its power is as the sine of half the angle formed by the rope; that is, as half the angle ACB, fig. 13.

A purchase upon this principle may be conveniently applied to several purposes. Thus, in the place of yard-tackles, let the blocks A and B, fig. 13, be fixed to the lower yard-arms, and through these blocks let there be rove a pendent with a hook at each end: the pendent should be long enough to reach the water on the opposite side, when one of the hooks are up at the yard-arm; for instance, with one hook up at B, the pendent should pass straight along the yard to A, and from A to the surface of the

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the water. On the bight of the pendent let there be a fiddle-blocke, the pendent leading through the upper sheave, and a whip-purchase through the lower one, coming down before the mast amid-ships. Now, when any thing is hoisting up by this purchase, for instance, the boat D, it will have the appearance as represented in the figure: if it be required to hoist in, on the opposite side, overhaul down the hook B. It will be proper to have a tricing-line, to trice up the block C when the purchase is not wanted.

For an example of a second application of this purchase, let us suppose that a boat's crew were about to haul their boat ashore, but should find their own power insufficient, and that they had no tackle. In this case, let them drive down a stake well up from the water, and a second close down to the water's edge; then let the boat's painter be made fast to the upper stake straight from the boat, and led round the lower one; now, by swigging off upon the painter midway between the stakes, the people will pull with much greater power; and if the power be yet insufficient, it is only moving the stakes further asunder.

Upon Dead-eyes, Hearts and Thimbles.

The power gained by dead-eyes, hearts and thimbles, is as the number of parts of the laniard that is

rove through them; but if the laniard be not well greased, their power will be mostly, if not entirely, counterbalanced by the friction they are subject to. This being the case, they are never applied as purchases, but merely for the better keeping the quantity gained of any shroud, or stay, when set up. For if a shroud, or stay, were set up without their application, the quantity lost upon making fast would slacken the shroud by the same quantity; but when a dead-eye and laniard are fixed to the shroud, should even *six* inches be lost upon making fast, the shroud would be slackened only *one* inch; for there are six parts of the laniard to the shroud, and as the shroud is equally held by each part, it can only be slackened by the quantity that the parts of the laniard are lengthened.

A general Rule for calculating the Power of Purchases.

A general proportion for calculating the power of any particular engine is, as the weight is to its space passed through, so the space passed through by the power is to the power: thus, suppose that a weight when hoisting up by a tackle should pass through one foot for every three feet hoist of the fall, then the power will be as one to three; and if the end of a handspec should pass through ten inches to prize up a weight one, the power will be as one to ten.

A Mechanical Increase of Power is Loss of Time.

Let us suppose that a person had to haul a hundred weight into a ship's top by a single rope, which is no purchase, then the length of the rope to pass through his hand would be equal to the height of the top from the deck; but if this person had to haul up the hundred weight by a whip purchase, then the length of the rope to pass through his hand would be equal to twice the height of the top from the deck; and admitting that the rope passed through the person's hands as fast in one case as the other, the weight would come up by the single rope in half the time that it would by the whip: which proves that an increase of power is loss of time,

Upon Friction.

The friction of most mechanical engines is so extremely compounded, as to make it difficult to say what is the precise quantity. Those metals will run the easiest together whose surfaces least adhere to each other; and it has been supposed that friction will follow a compound ratio of the surface pressed upon and the pressure; the greater the surface pressed upon, and the greater the pressure, the more will be the friction. Again, ropes if taught laid will not easily bend to small sheaves, but take

up considerable part of the power to force them into their proper direction; from which it follows that blocks with small pins, and large sheaves, and slack laid ropes, are the best materials to form tackles with. All blocks that are fixed are only for the convenience of turning the direction of a fall; they add nothing to the power of the purchase, but on the contrary destroy so much as is necessary to overcome their friction, therefore these blocks are to be avoided as much as possible.

C H A P. X.

Upon Leaks.

Upon the Pressure of Water, &c.

WATER presses as the square roots of its altitude, that is, suppose equal holes to be made in the bottom of a vessel at one foot, four feet, nine feet and sixteen feet beneath the surface of the water, then the water will rush in at these holes with a velocity equal to the square roots of their respective depths; for instance, at the four feet hole it will rush in twice as fast as at the one; at the nine feet, three times as fast; and at the sixteen feet, four times as fast; which is the law it will follow, provided the water be pumped out of the vessel

as fast as it comes in. If the water is suffered to rise up in the vessel and cover any of the holes, the covered holes will then all run with the same velocity regardless of their depths, which velocity will be as the square root of the difference of the level between the water within and without the vessel; for example, let us suppose that the hole at sixteen feet was quite at the bottom of the vessel, and that the water had risen in her eleven feet, then it would be just even with the nine feet hole, which runs with a velocity of three; but the difference of the level within and without is likewise nine feet, the square root of which is three; therefore these two holes will now run with the same velocity. From the foregoing reasoning it appears, that if a ship springs a leak under her bottom, though the water should increase upon the pumps at first, yet after the water has risen a certain height above the leak, the pumps will then be enabled to prevent it from rising higher.

Let us now consider how a leak in a vessel's bow and stern will be effected by her motion through the water. Let the leaks to be considered be of equal size, and nine feet deep, then the water will rush in at each leak with a velocity that may be expressed by three, while the ship is without motion and in still water; but if the vessel be given head-way, the water will increase running in at the bow by the head-way, and decrease at the stern in

the same proportion: and should she sail so fast as to double the running in of the water at the bow, the leak at the stern will become nothing. Thus, it appears that a leak at the bow is more dangerous than a leak at the stern. A leak also on the lee-side must be more dangerous than a leak on the weather-side; first, by its being forced deeper under water, and secondly increased by the lee-way.

The following rules, founded upon the foregoing reasoning, may lead to a discovery of the situation of a single leak. First, if the ship increases making water as she sails, the leak is in the bow; but on the contrary, if she decreases making water as she sails, the leak is in the stern; and, secondly, when sailing before the wind, if the ship makes neither more nor less water, the leak is on either side, which side may be discovered by hauling upon a wind; then if the ship makes more water it is on the lee-side, otherwise it is on the weather-side. It has been asserted, that by following round a leaky vessel in a calm with a pole, keeping one end applied to the ear and the other to the vessel's bottom, that should the end of the pole chance to pass near the leak a rumbling noise will be heard coming up the pole, and thus point out its place.

Should a leak be in the bow, it certainly may in a great measure be remedied at sea by spreading a tarred sail with oakum sewed to it across the bows,

bows, and confining it by ropes; then the motion of the vessel forward will press the sail close to the bow, and prevent the water from entering the leak. To a leak in any other part, the sail may not prove so effectual a remedy.

For preventing the water from entering the seams between wind and water, which some vessels by their working are continually emptying of their oakum, it will be better to nail double canvass, or leather with oakum beneath it along the seams, than to cover them with lead, which is subject to be broken.

It has frequently happened that ships have been left by their crews because the water gained upon the pumps, and that the same vessels have been met with afterwards and brought into port. If a ship's cargo when soaked in water would of itself float, there would be no danger of the ship's sinking, for as the water rose in the hold, the cargo immersed would become of no weight, but, on the contrary, would act as a support to the vessel by as much as it is lighter than water. Thus, a ship loaded with timber, though the water should be up to her decks, would not sink; and, probably, a ship loaded with spirits would not sink lower, after the whole cargo was immersed. Therefore, a commander knowing that his cargo when soaked in water will float, should be very backward in deserting his vessel, for he may yet find more safety
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on board her than in open boats. Dr. Franklin has recommended the bunging up all empty casks; these certainly must become a very active support, when they are immersed and prevented from rising higher by the deck.

C H A P. XI.

Upon Stowage.

On the Stowage of a Vessel depends her Easiness at Sea.

A TOLERABLE point for placing the centre of gravity of a vessel's cargo, if she is to be deeply laden, will probably be about half way between her keelson and centre of motion, which will be about a quarter of her beam up the hold; but if she is not to be deeply laden, her centre of gravity must be placed lower, otherwise the vessel will not have sufficient stability.

If the cargo is regular, *i. e.* consists uniformly of the same goods, let it be stowed fore and aft upon a level, observing not to fill up the breakages fore or aft with ballast, that the vessel's head and stern, which by her pitching are without support, may not be loaded beyond their capacity to bear.

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If the cargo should be irregular, the officer's judgment must be employed to distribute it in such a manner over the vessel that it may bear upon the different parts of her with the same equal strain as a regular cargo.

C H A P. XII.

Miscellaneous Articles.

Upon the polarity of a Sewing Needle.

THERE are few sewing needles but have a polarity, and when floated in water will tend to the magnetic meridian, the point of the needle going to the south. This is a necessary circumstance for seamen to be acquainted with, for should they be so unfortunate as to quit their vessels without a compass, by the aid of a common sewing needle, which seamen are seldom without, they are supplied with a tolerable substitute.

If a needle should be found without much polarity, hold the point towards the south, and rub it strongly from the middle towards the point with the back of a knife, and it will excite a very strong polarity.

A dry needle gently dropt into the water will swim of itself, but immediately on the upper part becoming wet it will sink,

If

If several rubbed needles be stuck together with their points one way through a very small piece of cork, they will move with a much quicker motion to the meridian than either of the needles singly.

Upon smoothing the Surface of the Sea, for the Purpose of Landing a Boat.

A quantity of oil being distributed over the surface of the sea will prevent it from breaking, and greatly contribute to lower the swell. Was a boat before attempting to land upon a lee shore, to bring up, and pour a quantity of oil upon the water, till it spread itself, and smoothed the water between her and the shore, she might then venture to weigh, and have considerable chance of reaching the shore with safety.

To preserve a Boat from Foundering in a Gale of Wind.

To preserve a boat from foundering in blowing weather, it will be necessary to have with her a small spar, as a top-gallant-yard. Let this spar be equally spanned, and to the middle of it be made fast three or four fathoms of rope, with the boat's grapnel at the end. Now should it come on to blow hard, and the boat be in danger of shipping a sea, bend the boat's cable to the middle of the span, and

and let her ride by the spar, which will be prevented from heaving on board the boat by the grapnel. Thus, by the spar's extending across the bows of the boat, it will prevent the sea from breaking over her.

It will be necessary to ride the boat very close to the spar, and when the spar is not wanted, (should it be too large to take on board the boat), it may be towed end on astern of her.

On the Manner of acting upon Accidents happening to the Helm; and a Description of a temporary Rudder.

Should a tiller break in a rudder-head, the rudder must immediately be chocked that the stump may be taken out and another tiller fitted, which should always be placed in readiness together with the chock, in case they should be wanted. While the rudder is useless, the ship must be hove-to till it is repaired; or some contrivance prepared to supply its place. The most ready application for supplying the place of a rudder is the following, till a better contrivance can be got ready. Let the end of a cable be led out through one of the gun-room ports, or midship cabin window, and brought in board again over the lee gang-way; then lash to it, 14 or 15 fathom from the end, about six pieces of junk, nearly three fathoms long, one beneath the other. To the bottom of the junk let several pigs

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of ballast be made fast, and to the top let a spar, or the buoys, be lashed straight along the cable, that the junk when veered astern may float in a perpendicular position. If it is thought necessary, the whole of this junked part may be stiffened, by lashing several pieces of plank across it. When the junked part is completed, let it be so spanned that as it tows astern it may be drawn over by ropes from quarter to quarter, without being pulled from its perpendicular position: the ropes from the span to lead through blocks fixed at the ends of two booms rigged out upon each quarter, either over the gunwale, or, in large ships, out through the after ports between decks. Thus prepared let the machine be hoisted over the side, and veered astern, to a necessary distance; then lash it amidships of the stern. When the junked part of the machine is amidships of the stern, let the steering ropes be hauled equally taught, and to them be fixed two stout guntackle purchases, coming from the fore part of the main chains. The falls of the guntackle purchases should be in one piece, coming in board on each side abreast of the barrel of the wheel, and leading under it, and several times about it; so that when the junked part of the machine is amidships, and the tackles equally taught, the middle of the falls may be in the centre turn upon the wheel, which middle should be marked, but *not nailed to the barrel of the wheel*, that the helmsman may know

know when the machine is amidships. To lead the falls after this manner; first, fix the blocks to the steering-ropes, and to the fore part of the main chains; then reeve the fall through the blocks on one side and lead it in board, and about the barrel of the wheel; then out board and through the blocks on the other side.

The leading of the falls under the wheel gives a great advantage, as the ship is steered by moving the wheel round the same way as if steering with a rudder. This contrivance will answer tolerably well, till the following rudder can be prepared, the invention of Captain Edward Pakenham of the Royal Navy.

1, Fig. 14, is a top-mast inverted, which forms the main piece of the rudder, its heel becoming the head, which is so secured by the anchor hoops, 9, that the fid-hole may be increased to receive a tiller. This main piece is pointed through a top-mast-cap, 7, which is enlarged, that the main piece may turn freely in it. Fig. 16, is a horizontal representation of the cap with its square part cut out to fit the sternpost, 8, having fixed to it the top-chains. 2, Fig. 14, is the inner half of a jibboom; 3 the outer half; 4 a fish, all of which are firmly bolted to the main piece, and planked over, as 6 6 6, &c.—10, 10, 10, are pigs of ballast to sink the heel of the rudder; 5 a rope to suspend the rudder. Fig. 15, anchor-stocks cut out to receive

receive the round part of the main piece of the rudder.—The whole machine being prepared, let it be got under the stern, and its head be hove up through the counter to a necessary height. Then, to each of the top-chains, bend the end of a hawser from the hawse-holes;—bear the rudder amidships, and heave well taught the hawsers, which will firmly secure the cap to the sternpost. This done, let the anchor-stocks be secured round the rudder head to the deck it comes through, that they may act as an upper gudgeon for the rudder to turn in:—the tiller, &c. being fixed, the vessel is now fitted with a rudder, nearly as perfect as her former.

To Steer a Vessel which has lost her Rudder, by another Vessel.

To steer a vessel which has lost her rudder, by another, let the *disabled vessel* take the other in tow, and make sail. To the tow-rope, at a few fathoms abaft the stern of the leading vessel, let steering-ropes be made fast, coming through blocks upon booms rigged out over each quarter and about the barrel of the wheel, as explained in the foregoing article. By turning the wheel round, the vessel astern is brought to tow a strain upon either quarter of the leading vessel, forming a sort of temporary rudder by which she may be steered as required.

Let

Let it be remembered that the vessel astern must steer the same course as the leading vessel; and when it is required to tack, the vessel astern should be sheered to leeward, and not put in stays till the leading vessel has come up three or four points in the wind.

Upon recovering a Vessel upright, without cutting away her Masts.

It often happens that by a sudden squall of wind a vessel is thrown over upon her beam ends, without a prospect of recovering her erect while she remains upon the same tack, therefore attempts are made to veer her; but as the rudder lies along the surface of the water it becomes useless, and as the sails are either blown from the yards, or become unmanageable, recourse is had to cutting away the main-mast and mizen-mast, that the ship may veer under the fore-mast:—a most desperate expedient, particularly if the ship is far distant from port! Upon this occasion, that the ship may be recovered upright without cutting away her masts, let the following method be practised. If she is in a situation where she can be brought to an anchor, let go her lee-anchor, which will swing her wind-ward, and relieve her from the strength of the wind; but should she, in this dreadful situation, be at sea, let the end of a hawser be handed over the

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lee-

lee-quarter and round to windward, and to it be bent any of the small anchors,—sparé spars,—spanned gratings,—or any thing at hand that will act as stopwaters; then throw the whole overboard, and veer away upon the hawser to a necessary quantity, when make it fast. Now by the ship's drifting from this tow, it will pull with such power upon her stern as to veer her, and bring the wind upon the opposite side, when the masts will prove of material service to right her.

To clear Vessels that have run aboard each other.

It frequently happens that two vessels which have run aboard each other are so completely bound together, either by the tide, or the wind and sea, that it is out of the power of the helm and sails to force them asunder. On this occasion, if the vessels are in a situation where they can come to an anchor, let one of them bring up and the other will drift clear of her: but should they be at sea, let the weathermost vessel be brought up by the floating anchor page 34, or by a tow from her bow, as mentioned in the foregoing article.

Upon Steering a Ship which has lost her Fore-mast.

A ship that has lost her fore-mast can only be steered with the wind aft, and that not without being

subject to broach-to. Directly a ship in this situation receives the wind sideways, all the lateral pressure of her sails will be abaft the centre of gravity, which her rudder not being able to counteract, must oblige her to approach the wind; but could the power of the rudder be increased to any required degree, a ship could be steered with the wind beaming, notwithstanding the loss of her fore-mast. To do which, let the following method be practised:—veer astern 20 or 30 fathom of cable, which, if the ship is in shoal water, should be buoyed up. Then rig out a boom with a stout guy upon each quarter, and let the guys be bent to the cable a few fathoms abaft the stern. While the ship is sailing before the wind, let the cable be guyed to tow amidships of the stern, and it will prevent her from broaching-to; but while the wind blows sideways upon the ship let it be guyed out to the lee-boom, which will greatly assist the weather-helm,

Upon Compasses, and Binacles,

When a compass is not in use its card should be taken off the point. All compass-cards that are unhung should be placed together in pairs, the North point of one to the South point of the other, wrapped up in dry brown paper, and separated a small distance from any other pair: if they be thus packed,

packed, their needles will increase in magnetical virtue.

Great care should be taken that the sides of all the binacles are placed in a line parallel to the longitudinal axis of the vessel, thus all the binacles will be parallel to each other; and as the lines within a compass bowl are parallel to the sides of its box, by placing either side of the compass box to either side of the binacle, the line in the compass bowl must stand parallel to the longitudinal axis of the vessel. For want of paying proper attention to setting the compasses parallel to each other, they are frequently said to differ, when upon a nicer examination out of the binacle they are found to agree.

Again, all binacles should be either pegged together, or nailed with *brass* nails.

THE END.



